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PART VII - CLEANUP STANDARDS

WAC 173-340-700 Overview of cleanup standards. (1) Purpose. This section provides an overview of the methods for establishing cleanup standards that apply to a release or threatened release of a hazardous substance at a site. If there are any inconsistencies between this section and any specifically referenced section, the referenced section shall govern.

(2) Cleanup standards versus selection of cleanup actions.

(a) Cleanup standards are identified for the particular hazardous substances at a site and the specific areas or pathways, such as land or water, where humans and the environment can become exposed to these substances. This part provides uniform methods state-wide for identifying cleanup standards and requires that all cleanups under the act meet these standards. The actual degree of cleanup may vary from site to site and will be determined by the cleanup action alternative selected under WAC 173-340-360. Establishing cleanup standards for individual sites requires the specification of the following:

(i) Hazardous substance concentrations that protect human health and the environment ("cleanup levels");

(ii) The location on the site where those cleanup levels must be attained ("points of compliance"); and

(iii) Additional regulatory requirements that apply to a cleanup action because of the type of action and/or the location of the site. These requirements are specified in applicable state and federal laws and are generally established in conjunction with the selection of a specific cleanup action.

(b) For most sites, there are several cleanup technologies or combinations of cleanup technologies ("cleanup action alternatives") that may be used to comply with cleanup standards at individual sites. Other parts of this rule govern the process for planning and deciding on the cleanup action to be taken at a site. For example, WAC 173-340-350 (State remedial investigation and feasibility study) (RI/FS) specifies the studies that are prepared to define the nature and extent of contamination ("RI") and to identify and evaluate cleanup action alternatives ("FS"). WAC 173-340-360 (Selection of cleanup actions) specifies the criteria for selecting the preferred alternative. WAC 173-340-410 specifies the monitoring required to assure that the remedy is effective.

(c) The department recognizes that cleanup actions selected under WAC 173-340-360 may involve containment of hazardous substances. In these cases, the cleanup action may be determined to comply with cleanup standards, provided the compliance monitoring program is designed to ensure the long-term integrity of the containment system, and the other requirements for containment technologies in WAC 173-340-360(8) are met.

(3) Three basic methods for establishing cleanup levels. These rules provide three approaches for establishing cleanup levels:

(a) Method A: Tables. On some sites, the cleanup action may be routine (WAC 173-340-130) or may involve relatively few hazardous substances. Under Method A, cleanup levels for hazardous substances are established at concentrations at least as stringent as concentrations specified in applicable state and federal laws and Tables 720-1, 740-1, and 745-1 of this chapter. Method A cleanup levels for hazardous substances not addressed under applicable state and federal laws or Tables 720-1, 740-1, and 745-1

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are established at concentrations which do not exceed the natural background concentration or the practical quantitation limit for the substance in question.

(b) Method B: Standard method. Method B is the standard method for determining cleanup levels for ground water, surface water, soil, and air. Cleanup levels for individual hazardous substances are established using applicable state and federal laws or the risk equations specified in WAC 173-340-720 through 173-340-750. For individual carcinogens, cleanup levels are based upon the upper bound of the estimated excess lifetime cancer risk of one in one million (1×10^{-6}). For individual noncarcinogenic substances, cleanup levels are set at concentrations which are anticipated to result in no acute or chronic toxic effects on human health and the environment. Where a hazardous waste site involves multiple hazardous substances and/or multiple pathways of exposure, method B cleanup levels for individual substances must be modified in accordance with the procedures in WAC 173-340-708. Under this method, the total excess lifetime cancer risk for a site shall not exceed one in one hundred thousand (1×10^{-5}) and the hazard index for substances with similar noncarcinogenic toxic effects shall not exceed one (1).

(c) Method C: Conditional method. ~~Compliance with cleanup levels developed under the method A or B may be impossible to achieve or may cause greater environmental harm. In those situations, method C cleanup levels for individual hazardous substances may be established on the basis of applicable state and federal laws and a site-specific risk assessment. Method C industrial soil cleanup levels may also be established at industrial properties which meet the criteria in WAC 173-340-745. Use of method C cleanup levels is limited to qualifying industrial properties. It may be used to establish soil and air cleanup levels on these properties. (See WAC 173-340-745 and – 750.)~~ For individual carcinogens, method C cleanup levels are based upon the upper bound of the estimated lifetime cancer risk of one in one hundred thousand (1×10^{-5}). For individual noncarcinogenic substances, method C cleanup levels are set at concentrations which are anticipated to result in no acute or chronic toxic effects on human health and no significant adverse effects on the protection and propagation of aquatic and terrestrial organisms. Where a hazardous waste site involves multiple hazardous substances and/or multiple pathways of exposure, method C cleanup levels for individual substances must be modified in accordance with the procedures in WAC 173-340-708. Under this method, the total excess lifetime cancer risk for a site shall not exceed one in one hundred thousand (1×10^{-5}) and the hazard index for substances with similar noncarcinogenic toxic effects shall not exceed one (1).

(4) Additional requirements for setting cleanup levels. Several requirements apply to cleanups under any of the three basic methods. Some of these requirements, such as the identification of applicable state and federal laws, describe analyses used along with methods A, B or C in order to set cleanup levels for particular substances at a site. Others describe the technical procedures to be used.

(a) Applicable state and federal laws. RCW 70.105D.030 (2)(d) requires the cleanup standards in these rules to be "at least as stringent as all applicable state and federal laws." In addition to establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710 and are similar to the "ARAR" (applicable, relevant and appropriate requirements) approach of the federal superfund law. Sites that are cleaned up under Ecology oversight through an order or decree may be exempted from certain permitting requirements.

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(b) Cross-media contamination. In some situations, migration of hazardous substances from one medium may cause contamination in a second media. For example, the release of hazardous substances in soil may cause ground water contamination. Under methods A, B, and C, cleanup levels must be established at concentrations which prevent violations of cleanup levels for other media following implementation of the cleanup action.

(c) Risk assessment procedures. The analyses performed under methods B and C use several factors for defining cleanup levels for carcinogens and noncarcinogens. The individual factors and procedures for modifying these factors based on new scientific information are specified in WAC 173-340-708 and 173-340-720 through 173-340-750. WAC 173-340-708 also provides rules for use of indicator hazardous substances.

(d) Natural background. ~~Cleanup levels shall not exceed concentrations established under methods A, B, or C except where the natural background concentration is greater than the cleanup level established under those methods. In such~~ In some cases, cleanup levels calculated using the methods specified in this chapter are less than natural background levels. In these situations, the cleanup level shall may be established at a concentration equal to the natural background concentration.

(5) ~~Threshold criteria for all cleanup actions. WAC 173-340-360 specifies that all cleanup actions conducted under this chapter shall protect human health and the environment, comply with cleanup standards and applicable state and federal laws, and provide for compliance monitoring. These are the threshold criteria and all cleanup actions must meet these criteria regardless of other factors such as cost or technical limitations.~~ Selecting remedies. [needs to be updated to reflect –360 changes.]

(6) Measuring compliance. Setting cleanup standards also involves being able to demonstrate that they have been met. This involves specifying where on the site the cleanup levels must be met ("points of compliance"), how long it takes for a site to meet cleanup levels ("restoration time frame"), and conducting sufficient monitoring to demonstrate that the cleanup standards have been met and will continue to be met in the future. The provisions for establishing points of compliance are in WAC 173-340-720 through 173-340-750. The provisions for establishing restoration time frames are in WAC 173-340-360. The compliance monitoring plan prepared under WAC 173-340-410 specifies precisely how these are measured for each site. Where cleanup levels are below the practical quantitation limit, compliance with cleanup standards will be based upon the practical quantitation limit.

(7) ~~Administrative principles for cleanup standards.~~ **[moved to –702.]**

~~(a) Remedial actions under this chapter shall be conducted in a manner that is consistent with this section. This section shall be used in combination with WAC 173-340-130, the more specific sections in Part VII of this chapter and WAC 173-340-360.~~

~~(b) Establishing cleanup standards and selecting an appropriate cleanup action involves many technical and public policy decisions. This chapter is intended to constrain the range of decisions needed to be made on individual sites to promote expeditious cleanups.~~

~~(c) The act contains policies which state, in part, each person has a fundamental and inalienable right to a healthful environment and it is essential that sites be cleaned up well. Consistent with these policies, cleanup standards under this chapter shall be established which provide conservative estimates of human health and environmental risks which protect susceptible individuals as well as the general population.~~

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~~— (d) Cleanup standards under this chapter shall be established which protect human health and the environment for current and potential future site and resource uses.~~

~~— (e) Cleanup actions that achieve cleanup levels under methods A, B or C (as applicable) and comply with applicable state and federal laws shall be presumed to be protective of human health and the environment.~~

~~— (f) Except as provided for in applicable state and federal laws, cost shall not be a factor in determining what cleanup level is protective of human health and the environment. In addition, where specifically provided for in this chapter, cost may be appropriate for certain other determinations related to cleanup standards such as point of compliance. Cost shall, however, be considered when selecting an appropriate cleanup action.~~

~~— (g) At most sites, there is more than one hazardous substance and more than one pathway for hazardous substances to get into the environment. For many sites there is more than one technology that could address each of these. When evaluating cleanup action alternatives it is appropriate to consider a representative range of technologies that could address each of these as well as different combinations of these technologies to accomplish the overall site cleanup.~~

~~— (h) The cleanup of a particular media of a site will often affect other media at the site. These cross-media impacts shall be considered when establishing cleanup standards and selecting a cleanup action. Cleanup actions conducted under this chapter shall use appropriate engineering controls or other measures to minimize these cross-media impacts.~~

~~— (i) In general, cleanup levels must be met throughout a site before the site will be considered to be clean. A remedy that leaves hazardous substances on a site in excess of cleanup levels may qualify as a cleanup action as long as the remedy is protective of human health and the environment, meets cleanup levels at specified points of compliance, complies with applicable state and federal laws, provides for adequate monitoring, and incorporates appropriate institutional controls. However, these rules are intended to promote thorough cleanups rather than long-term partial cleanups or containment measures.~~

(7) TPH Overview. Cleanup levels for petroleum hydrocarbons (“total petroleum hydrocarbons”--TPH) can be determined by Method A (tables, natural background, practical quantitation limits, or other applicable or appropriate requirements) or by a “tiered” process that results in Method B or Method C determined levels. These tiers are modeled on the American Society for Testing and Materials (ASTM) Risk Based Corrective Action (RBCA) three-tiered evaluation process for assessing the risk of contaminants at a site and with higher tiers increasing in complexity. The intent is for sites to set cleanup levels as early in the evaluation as possible and only proceeding to higher tiers when site complexity requires it. The Ecology TPH process also has expanded to include a lower level tier (Method A) that is protective of any site to allow additional sites to easily determine TPH cleanup levels. Tiers 1, 2, and 3 do not result in a single determined result but rather options that reflect site-specific conditions so that the cleanup levels are both site-specific and risk-based. In order to protect both human health and the environment, the Ecology TPH tiered process not only evaluates human health risk but also environmental risk to plants and animals, both terrestrial and aquatic. Establishing cleanup standards for TPH requires:

(i) A “Conceptual Site Model” (CSM) to describe the possible exposure pathways between the contaminants and the exposed population. A CSM is required for each

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site, unless Method A (which does not rely on a CSM) is used. A CSM will account for sources, transport mechanisms, land uses, potentially exposed human and animal populations, and exposure routes.

(ii) Analytical techniques that quantitate equivalent carbon fractions of the TPH ("fractionated TPH") are necessary for Tiers 1, 2, and 3. Also, analytical techniques are used to quantitate individual TPH "chemicals of concern" or "indicator" compounds, as appropriate, for the release. The measurement of chemicals of concern and TPH fractions allows the use of surrogate toxicity and physical chemistry data to represent the TPH. Method A can be determined using chemical of concern data in addition to analytical techniques for "total" concentrations (not fractions) for different product types, such as methods for "gasoline" (NWTPH-Gx) and "diesel" (NWTPH-Dx).

(iii) At a minimum, analyses for gasoline or unknown substances that may contain gasoline must analyze for benzene, toluene, ethylbenzene, xylenes, and hexane.

(iv) All the applicable requirements of MTCA must be met for TPH.

(b) TPH tiers.

(A) TPH tiers do not replace MTCA methods A, B, or C. They may be used as a way to organize the cleanup level setting process for TPH. Since they must comply with the requirements for the corresponding methods and media, the use of the nomenclature is optional. The following is a description of the tiers and methods:

(I) Method A provides cleanup levels for TPH types (not using fractionated TPH) and individual TPH chemicals of concern, such as benzene. A site assessment to support Method A must obtain TPH data and chemical concentrations that are likely to represent the most impacted areas at the site.

(B) Tier 1 is a Method B or Method C site assessment that uses screening levels and assessments for complete or incomplete exposure pathways. Fractionated TPH data is necessary in Tier 1 and above.

(C) Tier 2 is a Method B or Method C site-specific assessment. Tier 2 requires exposure and fate and transport information that are specific to the site so that pathway modeling may be done.

(D) Tier 3 is a complex Method B or Method C site assessment. The data necessary for a Tier 3 analysis are usually very specific.

(c) Any Tier 1, 2, or 3 site assessment should provide, at a minimum, the following data:

(i) Determination of actual or potential exposure pathways;

(ii) Identification of chemical source area(s) and maximum concentrations of chemicals of concern; and

(iii) Identification of site conditions which affect or limit chemicals of concern.

WAC 173-340-702 General policies. Purpose. This section defines the policies and principles that ~~the department shall utilize to ensure that cleanup standards under this chapter are established and implemented in a scientifically and technically sound manner.~~ shall be followed when establishing cleanup standards and selecting remedies under this chapter. This section shall be used in combination with WAC 173-340-130, the more specific sections in Part VII of this chapter and WAC 173-340-360.

[Note: Subsections 2 through 9 are subsections moved from WAC 173-340-700(7) with minor revisions highlighted in bold. Subsections 10-14 are current rule

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language already in this Section modified as shown. Subsection 15 is from the PaC recommendation.]

(2) Expediting Cleanups. Establishing cleanup standards and selecting an appropriate cleanup action involves many technical and public policy decisions. This chapter is intended to constrain the range of decisions needed to be made on individual sites to promote expeditious cleanups.

(3) Protection. The act contains policies which state, in part, each person has a fundamental and inalienable right to a healthful environment and it is essential that sites be cleaned up well. Consistent with these policies, cleanup standards under this chapter shall be established which provide conservative estimates of human health and environmental risks which protect susceptible individuals as well as the general population.

(4) Future Resources. Cleanup standards under this chapter shall be established which protect human health and the environment for current and potential future site and resource uses.

(5) Presumption. Cleanup actions that achieve cleanup levels under methods A, B or C (as applicable) and comply with applicable state and federal laws shall be presumed to be protective of human health and the environment.

(6) Cost. Except as provided for in applicable state and federal laws, cost shall not be a factor in determining what cleanup level is protective of human health and the environment. In addition, where specifically provided for in this chapter, cost may be appropriate for certain other determinations related to cleanup standards such as point of compliance. Cost shall, however, be considered when selecting an appropriate cleanup action.

(7) Cleanup action components. At most sites, there is more than one hazardous substance and more than one pathway for hazardous substances to get into the environment. For many sites there is more than one cleanup action component that could address each of these. When evaluating cleanup action alternatives it is appropriate to consider a representative range of cleanup action components that could address each of these as well as different combinations of these technologies components to accomplish the overall site cleanup.

(8) Cross-media Impacts. The cleanup of a particular media of a site will often affect other media at the site. These cross-media impacts shall be considered when establishing cleanup standards and selecting a cleanup action. Cleanup actions conducted under this chapter shall use appropriate engineering controls or other measures to minimize these cross-media impacts.

(9) Cleanup Levels vs Remedies. In general, cleanup levels must be met throughout a site before the site will be considered to be clean. A remedy that leaves hazardous substances on a site in excess of cleanup levels may be selected as a cleanup action as long as the remedy meets the requirements in WAC 173-340-360 through 3XX. However, these rules are intended to promote thorough cleanups rather than long-term partial cleanups or containment measures.

(2) (10) Relationship to federal cleanup law. When evaluating cleanup actions performed under the federal cleanup law, the department shall consider WAC 173-340-360, WAC 173-340-410, 420 & 440 and 173-340-700 through 173-340-760 to be a legally applicable requirement under Section 121(d) of the Federal Cleanup Law.

(3) (11) Regulation update. The department shall review and, as appropriate, update WAC 173-340-700 through 173-340-760 no less frequently than once every five years.

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~~(4) (12) Institutional controls. Institutional controls under WAC 173-340-440 shall be required whenever any of the circumstances identified in WAC 173-340-440(3) are present at a site, a cleanup action results in residual concentrations of hazardous substances which exceed method A or method B cleanup levels, as applicable, or conditional points of compliance are approved by the department under WAC 173-340-720 through 173-340-760. Institutional controls shall also be required when cleanup levels are established under WAC 173-340-745.~~

~~(5) (13) Burden of proof. Any person responsible for undertaking a cleanup action under this chapter who proposes to: (a) Use a reasonable maximum exposure scenario other than the default provided for each medium; (b) Use assumptions other than the default values provided for in this chapter; (c) Establish a cleanup level under method C or, (d) Use a conditional point of compliance, shall have the burden of demonstrating to the department that requirements in this part Part VII of this chapter have been met to assure protection of human health and the environment. The department shall only approve cleanup levels under method C or conditional points of compliance of such proposals when it determines that the person undertaking the cleanup actions met this burden of proof is met.~~

~~(6) (14) New scientific information. The department shall consider new scientific information when establishing cleanup levels and remediation levels for individual sites. In making a determination on how to use this new information, the department shall, as appropriate, consult with the science advisory board, the department of health, and the United States Environmental Protection Agency. Any proposal to use new scientific information shall meet the quality of information requirements in subsection (15) of this section. To minimize delay in cleanups, any proposal to use new scientific information should be introduced as early in the cleanup process as possible. Proposals to use new scientific information may be considered up to the time of issuance of the order or decree governing the final cleanup action for a site unless triggered as part of a periodic review under WAC 173-340-420 or through a reopener under RCW 70.105D.040(4)(c).~~

~~(15) Quality of Information. (a) The intent of this subsection is to establish minimum criteria to be considered when evaluating information used by or submitted to the department proposing to modify the methods or factors specified in this chapter or proposing methods or factors not specified in this chapter for calculating cleanup levels and remediation levels. This subsection does not establish a burden of proof or alter the burden of proof provided for elsewhere in this chapter.~~

~~(b) When deciding whether to approve or require modifications to the default methods or factors specified in this chapter for establishing cleanup levels and remediation levels or when deciding whether to approve or require alternative or additional methods or factors, the Department shall consider information submitted by all interested persons and the quality of that information. When evaluating the quality of the information the Department shall consider the following factors, as appropriate for the type of information submitted:~~

~~(i) Whether the information is based on a theory or technique that has wide spread acceptance within the relevant scientific community;~~

~~(ii) Whether the information was derived using standard testing methods or other widely accepted scientific methods;~~

~~(iii) Whether a review of relevant available information, both in support of and not in support of the proposed modification, has been provided along with the rationale explaining the reasons for the proposed modification;~~

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(iv) Whether the assumptions used in applying the information to the facility are valid and would assure the proposed modification would err on behalf of protection of human health and the environment;

(v) Whether the information adequately addresses populations that are more highly exposed than the population as a whole and are reasonably likely to be present at the site; and

(vi) Whether adequate quality assurance and quality control procedures have been used, any significant anomalies are adequately explained, the limitations of the information are identified, and the known or potential rate of error is acceptable.

[NOTE: The need for guidance vs. more specific rule language was highlighted in previous drafts as an area potentially needing further discussion. Ecology is proposing to leave the rule language above intact and commit to preparation of guidance.]

WAC 173-340-704 Use of Method A. (1) When to use Method A. Method A may be used to establish cleanup levels at the following types of sites:

(a) Sites undergoing routine cleanup actions as defined in WAC 173-340-130; or
(b) Sites where numerical standards are available in this chapter or applicable state and federal laws for all indicator hazardous substances in all media of concern;

(c) For establishing soil cleanup levels only, sites that are not ecologically sensitive (tier III) sites as defined in WAC 173-340-709; and,

(d) At sites with a limited number of hazardous substances with the same toxic effect and at sites without multiple additive exposure pathways (i.e. at sites where additive effects need not be considered).

(2) How Method A cleanup levels are determined. Method A cleanup levels shall be established in accordance with the procedures in WAC 173-340-720 through 173-340-760. Method A cleanup levels shall be at least as stringent as all of the following:

(a) Concentrations of individual hazardous substances listed in the tables 720-1, 740-1 or 745-1 in WAC 173-340-720, 173-340-740, or 173-340-745 in this chapter;

(b) Concentrations of individual hazardous substances established under applicable state and federal laws; and

(c) For individual hazardous substances deemed indicator hazardous substances for the medium of concern under WAC 173-340-708(2) and not addressed under (a) and (b) of this subsection, concentrations that do not exceed natural background levels or the practical quantitation limit for the substance in question. [NOTE: Users should consider using method B, rather than method A, to establish cleanup levels at these sites.]

(3) Protectiveness. The department may establish method A cleanup levels more stringent than those required by subsection (2) of this section, when based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-702 & 708.

~~(4) Use of Method A Tables. Caution on misusing method A tables. Method A tables have been developed for specific purposes. They are intended to provide conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate,~~

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~~insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter.~~

(4) Adjustments to ARARs. Where a cleanup level is based on an applicable state or federal law, and the level of risk upon which the ARAR is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the risk for each individual hazardous substance does not exceed an excess cancer risk of one in one hundred thousand (1×10^{-5}) and a hazard quotient of one (1).

(5) Natural Background and PQL Considerations. Cleanup levels determined using method A, including cleanup levels adjusted under subsection (4) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

~~(5)~~ (6) If there are any inconsistencies between this section and any specifically referenced sections, the referenced section shall govern.

WAC 173-340-705 Use of Method B. (1) When to use Method B. Method B is applicable to all sites. It shall be used to develop cleanup levels unless one or more of the conditions for using method A or method C are demonstrated to exist and the person conducting the cleanup action elects to utilize that method.

(2) How Method B cleanup levels are determined. Method B cleanup levels shall be established in accordance with the procedures in WAC 173-340-720 through 173-340-760. Method B cleanup levels shall be at least as stringent as all of the following:

(a) Concentrations of individual hazardous substances established under applicable state and federal laws;

(b) Concentrations which are estimated to result in no significant adverse effects on the protection and propagation of aquatic and terrestrial life using the procedures specified in WAC 173-340-709; [this reference may not longer be appropriate since aquatic life isn't addressed in 709--need to check with Nigel]

(c) For hazardous substances for which ~~sufficiently protective~~, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health ~~and the environment~~ as determined by the following methods:

(i) Concentrations which are estimated to result in no acute or chronic toxic effects on human health as determined using a hazard quotient of one (1.0) and the procedures specified in WAC 173-340-720 through 173-340-760;

(ii) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}) as determined using the procedures specified in WAC 173-340-720 through 173-340-760; and

(iii) Concentrations which eliminate or minimize the potential for food chain contamination; ~~and~~

(3) Protectiveness. The department may establish method B cleanup levels that are more stringent than those required by subsection (2) of this section, when based upon a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-702 & 708.

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(4) Adjustments for multiple contaminants and exposure pathways. Concentrations of individual hazardous substances established under subsections (2) and (3) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures in WAC 173-340-708. In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}). These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, ~~including cleanup levels based on applicable state and federal laws.~~

(5) Adjustments to ARARs. ~~Where a cleanup level is based on an applicable state or federal law, and the level of risk upon which the ARAR is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk and hazard index at the site does not exceed the limits established in subsection (4) of this section.~~

(6) Mixing Methods A and B. Method A values from tables 720-1 or 740-1 may be used in combination with method B calculated values provided:

~~(a) Adjustments are made for multiple contaminants and exposure pathways as described in subsection (4) of this section;~~

~~(b) The site is not an environmentally sensitive (tier III) site under WAC 173-340-709; and,~~

~~(c) For each hazardous substance in each medium, the same approach must be used throughout a site. For example, for a given contaminant, one cannot use method A for part of the soil on a site and method B for other soils on the same site.~~

(7) Natural Background and PQL Considerations. Cleanup levels determined using method B, including cleanup levels adjusted under subsections (4) and (5) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

(8) If there are any inconsistencies between this section and any specifically referenced sections, the referenced section shall govern.

WAC 173-340-706 Use of Method C. (1) When to use Method C. Method C cleanup levels represent concentrations which are protective of human health and the environment for specified site uses and conditions. A site (or portion of a site) that qualifies for a method C cleanup level for one medium does not necessarily qualify for a method C cleanup level in other media. Each medium must be evaluated separately using the criteria applicable to that medium.

(a) Method C cleanup levels may be ~~established~~ used for a medium at a site where the person conducting the cleanup action can demonstrate that such levels comply with applicable state and federal laws, that all practicable methods of treatment are utilized, that institutional controls are implemented in accordance with WAC 173-340-440, and that one or more of the following conditions exist:

~~(i) Where method A or B cleanup levels are below area background concentrations, method C cleanup levels may be established at concentrations that are equal to area background concentrations, but in no case greater than concentrations specified in subsection (2) of this section; or~~

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~~(ii) Where attainment of method A or B cleanup levels has the potential for creating a significantly greater overall threat to human health or the environment than attainment of method C cleanup levels established under this chapter, method C cleanup levels may be established at concentrations which minimize those overall threats, but in no case greater than concentrations specified in subsection (2) of this section. Factors that shall be considered in making this determination include:~~

- ~~—— (A) Results of a site-specific risk assessment;~~
- ~~—— (B) Duration of threats;~~
- ~~—— (C) Reversibility of threats;~~
- ~~—— (D) Magnitude of threats; and~~
- ~~—— (E) Nature of affected population.~~

~~(iii) Where method A or B cleanup levels are below technically possible concentrations, method C cleanup levels may be established at the technically possible concentrations, but in no case greater than levels specified in subsection (2) of this section.~~

~~(b) (i) For soil cleanup levels only, Method C cleanup levels may also be established, where the person conducting the cleanup action can demonstrate that the area under consideration is an industrial property and meets the criteria for establishing industrial soil cleanup levels under WAC 173-340-745. [NOTE: The requirement for “all practical methods of treatment” as a precondition for use of method C cleanup levels does not apply to industrial soil cleanup levels. See WAC 173-340-745 for criteria for use of industrial soil cleanup levels.]~~

~~(iii) For air cleanup levels, for facilities qualifying as industrial property under WAC 173-340-745 and for structures accessible only to adult workers. (see WAC 173-340-750)~~

~~(2) How Method C cleanup levels are determined. Method C cleanup levels shall be established in accordance with the procedures in WAC 173-340-720 through 173-340-760. Method C cleanup levels shall be at least as stringent as all of the following:~~

- ~~(a) Concentrations established under applicable state and federal laws;~~
- ~~(b) Concentrations which are estimated to result in no significant adverse effects on the protection and propagation of aquatic and terrestrial life using the procedures specified in WAC 173-340-709.~~

~~(c) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which are protective of human health and the environment as determined by the following methods:~~

~~(i) Concentrations which are estimated to result in no significant adverse acute or chronic toxic effects on human health as estimated using a hazard quotient of one (1) and the procedures defined in WAC 173-340-720 745 through 173-340-760; and,~~

~~(ii) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one hundred thousand (1 X 10⁻⁵) as determined using the procedures defined in WAC 173-340-720 745 through 173-340-760; and~~

~~(iii) Concentrations which eliminate or minimize the potential for food chain contamination.~~

~~(3) Protectiveness. The department may establish method C cleanup levels that are more stringent than those required by subsection (2) of this section when based upon a site-specific evaluation, the department determines that such levels are necessary to~~

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protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-702 & 708.

(4) Adjustments for multiple contaminants and exposure pathways. Concentrations of individual hazardous substances established under subsections (2) and (3) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with WAC 173-340-708. In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}). These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway.

(5) Adjustments to ARARs. Where a cleanup level is based on an applicable state or federal law and the level of risk upon which the ARAR is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk and hazard index at the site does not exceed the limits established in subsection (4) of this section.

(6) Mixing methods A and C. Method A values in tables 720-1, 740-1 or 745-1 may be used in combination with method C calculated values provided:

(a) Adjustments are made for multiple contaminants and exposure pathways as described in subsection (4) of this section;

(b) The site is not an environmentally sensitive (tier III) site under WAC 173-340-709; and,

(c) For each hazardous substance in each medium, the same approach must be used throughout a site. For example, for a given contaminant, one cannot use method A for part of the soil on a site and method B for other soils on the same site.

(7) Natural Background and PQL Considerations. Cleanup levels determined using method C, including cleanup levels adjusted under subsections (4) and (5) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

(8) If there are any inconsistencies between this subsection and any specifically referenced sections, the referenced section shall govern.

WAC 173-340-707 Analytical considerations. (1) Analytical methods used to evaluate the effectiveness of a cleanup action shall comply with the requirements in WAC 173-340-830.

(2) The department recognizes that there may be situations where a hazardous substance is not detected or is detected at a concentration below the practical quantitation limit utilizing sampling and analytical procedures which comply with the requirements of WAC 173-340-830. If those situations arise and the practical quantitation limit is higher than the cleanup level for that substance, the cleanup level shall be considered to have been attained, subject to subsection (4) of this section, only when the more stringent of the following conditions are met:

(a) The practical quantitation limit is no greater than ten times the method detection limit; or

(b) The practical quantitation limit for the particular hazardous substance, medium, and analytical procedure is no greater than the practical quantitation limit established by

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the United States Environmental Protection Agency and used to establish requirements in 40 CFR 136, 40 CFR 141 through 143, or 40 CFR 260 through 270.

(3) In cases where a cleanup level required by this chapter is less than the practical quantitation limit using an approved analytical procedure, the department may also require one or more of the following:

(a) Use of surrogate measures of hazardous substance contamination;

(b) Use or development of specialized sample collection or analysis techniques to improve the method detection limit or practical quantitation limit for the hazardous substances at the site; or

(c) Monitoring to assure that the concentration of a hazardous substance does not exceed detectable levels.

(4) When the practical quantitation limit is above the cleanup level, the department shall consider the availability of improved analytical techniques when performing periodic reviews under WAC 173-340-420. Subsequent to those reviews, the department may require the use of improved analytical techniques with lower practical quantitation limits and other appropriate actions.

WAC 173-340-708 Human health risk assessment procedures. (1) Purpose. This section defines the risk assessment framework that ~~the department will utilize~~ shall be used to establish cleanup levels and remediation levels under this chapter. As used in this section, cleanup levels and remediation levels means the human health risk assessment component of these levels. This chapter defines certain default values and methods to be used in calculating cleanup levels and remediation levels. This section allows varying from these default values and methods under certain circumstances. When deciding whether to approve alternate values and methods the department shall ensure that the use of alternative values and methods will not significantly delay site cleanups.

(2) Selection of indicator hazardous substances.

(a) When defining cleanup requirements at a site that is contaminated with a large number of hazardous substances, the department may eliminate from consideration those hazardous substances that contribute a small percentage of the overall threat to human health and the environment. The remaining hazardous substances shall serve as indicator hazardous substances for purposes of defining site cleanup requirements.

(b) If the department considers this approach appropriate for a particular site, the factors evaluated when eliminating individual hazardous substances from further consideration shall include:

(i) The toxicological characteristics of the hazardous substance that influence its ability to adversely affect human health or the environment relative to the concentration of the hazardous substance at the site;

(ii) The chemical and physical characteristics of the hazardous substance which govern its tendency to persist in the environment;

(iii) The chemical and physical characteristics of the hazardous substance which govern its tendency to move into and through environmental media;

(iv) The natural background concentrations of the hazardous substance;

(v) The thoroughness of testing for the hazardous substance at the site;

(vi) The frequency that the hazardous substance has been detected at the site; and

(vii) Degradation by-products of the hazardous substance.

(c) When the department determines that the use of indicator hazardous substances is appropriate for a particular site, it may also require biological testing to

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address potential toxic effects associated with hazardous substances eliminated from consideration under this subsection.

(3) Reasonable maximum exposure. (a) Cleanup levels and remediation levels shall be based on estimates of current and future resource uses and reasonable maximum exposures expected to occur under both current and potential future site use conditions.

(b) The reasonable maximum exposure is defined as the highest exposure that is reasonably expected to occur at a site under current and potential future site use. WAC 173-340-720 through 173-340-760 define the reasonable maximum exposures for ground water, surface water, soil, and air. These reasonable maximum exposures will apply to most sites where individuals or groups of individuals are or could be exposed to hazardous substances. For example, the reasonable maximum exposure for most ground water is defined as exposure to hazardous substances in drinking water and other domestic uses.

(c) Persons performing cleanup actions under this chapter may utilize the evaluation criteria in WAC 173-340-720 through 173-340-760 to demonstrate that the reasonable maximum exposure scenarios specified in those sections are not appropriate for cleanup levels for a particular site. The use of an alternate exposure scenario shall be documented by the person performing the cleanup action. Documentation for the use of alternate exposure scenarios under this provision shall be based on the results of investigations performed in accordance with WAC 173-340-350.

(d) Persons performing cleanup actions under this chapter may also use alternate reasonable maximum exposure scenarios to assess the protectiveness of a remedy that uses engineered controls and/or institutional controls to limit exposure to the contamination remaining on the site. An alternate reasonable maximum exposure scenario shall reflect the highest exposure that is reasonably expected to occur under current and potential future site exposure considering, among other appropriate factors, the potential for institutional controls to fail and the extent of the time period of failure under these scenarios. For example, if a cap (with appropriate institutional controls) is the proposed remedy at a commercial site, the reasonable maximum exposure scenario for assessing the protectiveness of the cap with regard to direct soil contact could be changed from a child living on the site to a construction or maintenance worker and child trespasser scenario.

~~(d)~~(e) Individuals or groups of individuals may be exposed to hazardous substances through more than one exposure pathway. For example, a person may be exposed to hazardous substances from a site by drinking contaminated ground water, eating contaminated fish, and breathing contaminated air. At sites where the same individuals or groups of individuals are or could be consistently exposed through more than one pathway, the reasonable maximum exposure shall represent the total exposure through all of those pathways. At such sites, the cleanup levels and remediation levels derived for individual pathways under WAC 173-340-720 through 173-340-760 and WAC 173-340-360 shall be adjusted downward to take into account multiple exposure pathways.

(4) Cleanup levels and remediation levels for individual hazardous substances. Cleanup levels for individual hazardous substances will generally be based on a combination of requirements in applicable state and federal laws and risk assessment. Remediation levels will generally be based on a variety of factors described in WAC 173-340-360, including risk assessment considerations.

(5) Multiple hazardous substances.

(a) Cleanup levels for individual hazardous substances established under methods B and C and remediation levels shall be adjusted downward to take into account exposure

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to multiple hazardous substances. Adverse effects resulting from exposure to two or more hazardous substances ~~with similar types of toxic response~~ that affect the same organ system are assumed to be additive unless scientific evidence is available to demonstrate otherwise.

(b) Cancer risks resulting from exposure to two or more carcinogens are assumed to be additive unless scientific evidence is available to demonstrate otherwise.

(c) For purposes of establishing cleanup levels for noncarcinogens under methods B and C, and for remediation levels the health threats resulting from exposure to two or more hazardous substances ~~with similar types of toxic response~~ that affect the same organ system may be apportioned between those hazardous substances in any combination as long as the hazard index does not exceed one (1).

(d) For purposes of establishing cleanup levels for carcinogens under methods B and C, and for remediation levels, the cancer risks resulting from exposure to multiple hazardous substances may be apportioned between hazardous substances in any combination as long as the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}).

(e) The department may require biological testing to assess the potential interactive effects associated with chemical mixtures.

(f) When making adjustments to cleanup levels and remediation levels for multiple hazardous substances, the concentration for individual hazardous substances should not be adjusted downward to less than the practical quantitation limit or natural background.

(6) Multiple pathways of exposure.

(a) Estimated doses of individual hazardous substances resulting from more than one pathway of exposure are assumed to be additive unless scientific evidence is available to demonstrate otherwise.

(b) Cleanup levels and remediation levels based on one pathway of exposure shall be adjusted downward to take into account exposures from more than one exposure pathway. The number of exposure pathways considered at a given site shall be based on the reasonable maximum exposure scenario as defined in WAC 173-340-708(3).

(c) For purposes of establishing cleanup levels for noncarcinogens under methods B and C, and remediation levels, the health threats associated with exposure via multiple pathways may be apportioned between exposure pathways in any combination as long as the hazard index does not exceed one (1).

(d) For purposes of establishing cleanup levels for carcinogens under methods B and C, and for remediation levels, the cancer risks associated with exposure via multiple pathways may be apportioned between exposure pathways in any combination as long as the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}).

(f) When making adjustments to cleanup levels and remediation levels for multiple pathways of exposure, the concentration for individual hazardous substances should not be adjusted downward to less than the practical quantitation limit or natural background.

(7) Reference doses . Noncarcinogenic Toxicity Values

(a) The chronic reference dose/reference concentration and the developmental reference dose/reference concentration shall be used to establish cleanup levels and remediation levels under this chapter. Cleanup levels and remediation levels shall be established using the value which results in the most protective concentration.

(b) Inhalation reference doses/reference concentrations shall be used in WAC 173-340-750. Where the inhalation reference dose/reference concentration is reported as a concentration in air, that value shall be converted to a corresponding inhaled intake

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(mg/kg-day) using a human body weight of 70 kg and an inhalation rate of 20 m³/day, and take into account, where available, the respiratory deposition and absorption characteristics of the gases and inhaled particles.

(c) A subchronic reference dose/reference concentration may be utilized to evaluate potential noncarcinogenic effects resulting from exposure to hazardous substances over short periods of time. This value may be used in place of the chronic reference dose/reference concentration where it can be demonstrated that a particular hazardous substance will degrade to negligible concentrations during the exposure period.

(d) For purposes of establishing cleanup levels and remediation levels for hazardous substances under this chapter, a reference dose/reference concentration established by the United States Environmental Protection Agency and available through the "integrated risk information system" ("IRIS") data base shall be used. If a reference dose/reference concentration is not available through the IRIS data base, a reference dose/reference concentration from the U.S. EPA Health Effects Assessment Summary Table ("HEAST") data base shall be used.

(e) If a reference dose/reference concentration is available through the IRIS or HEAST data bases, it shall be used unless the department determines that there is clear and convincing scientific data which demonstrates that the use of this value is inappropriate.

~~(e) (f) If a reference dose/reference concentration is not available through the "integrated risk information system" IRIS data base or the HEAST data base or is demonstrated to be inappropriate under (d) (e) of this subsection, a reference dose/reference concentration shall be established utilizing the methods described in the most appropriate EPA risk assessment/toxicological guidance documents. Risk Assessment Guidance for Superfund. Human Health Evaluation Manual, Part A. (October 1989.)~~

(g) Unless otherwise available through IRIS or HEAST, or the department determines that there is clear and convincing scientific data which demonstrates the use of the following values are inappropriate, the following reference doses shall be used when conducting a site-specific risk assessment for petroleum mixtures:

<u>Hazardous Substance</u>	<u>Oral reference Dose (mg/kg-day)</u>	<u>Inhalation Reference Dose (mg/kg-day)</u>
<u>1,2-Dibromoethane</u>	<u>0.00005</u>	--
<u>MTBE</u>	<u>0.005</u>	<u>0.86</u>
<u>Napthalene</u>	--	<u>0.00011</u>
<u>TPH Fractions</u>		
<u>Low Aliphatics</u>	<u>2</u>	<u>0.057</u>
<u>Middle Aliphatics</u>	<u>0.6</u>	<u>0.6</u>
<u>High Aliphatics</u>	<u>2</u>	--
<u>Aromatics</u>	<u>0.03</u>	<u>0.114</u>

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~~(f)~~ (h) In estimating a reference dose/reference concentration for a hazardous substance under (e), ~~(f)~~ or a value different than the default values in (g) of this subsection, the department shall consult with the science advisory board, the department of health, and the United States Environmental Protection Agency and may, as appropriate, consult with other qualified persons. Scientific data supporting such a change shall be subject to the requirements under WAC 173-340-702(15).

~~(g)~~ (i) Where a reference dose/reference concentration other than those established under (d) or (g) of this subsection is used to establish a cleanup level or remediation level at individual sites, the department shall summarize the scientific rationale for the use of those values in the cleanup action plan. The department shall provide the opportunity for public review and comment on this value in accordance with the requirements of WAC 173-340-360 and 173-340-600.

(8) Carcinogenic ~~potency factor~~ toxicity values.

(a) For purposes of establishing cleanup levels and remediation levels for hazardous substances under this chapter, a carcinogenic potency factor established by the United States Environmental Protection Agency and available through the "integrated risk information system" IRIS data base shall be used. If a cancer potency factor is not available from the IRIS data base, a cancer potency factor from the HEAST data base shall be used.

(b) If a cancer potency factor is available from the IRIS or HEAST data bases it shall be used unless the department determines that there is clear and convincing scientific data which demonstrates that the use of this value is inappropriate.

~~—(b)~~ (c) If a carcinogenic potency factor is not available through the "integrated risk information system" IRIS or HEAST data bases or is demonstrated to be inappropriate under ~~(a)~~ (b) of this subsection, one of the following methods shall be utilized to establish a carcinogenic potency factor:

(i) The carcinogenic potency factor may be derived from appropriate human epidemiology data on a case-by-case basis; or

(ii) The carcinogenic potency factor may be derived from animal bioassay data using the following procedures:

(A) All ~~carcinogenesis~~ carcinogenicity bioassays shall be reviewed and data of appropriate quality shall be used for establishing the carcinogenic potency factor.

(B) The linearized multistage extrapolation model shall be utilized to estimate the slope of the dose-response curve unless the department determines that there is clear and convincing scientific data which demonstrates that the use of an alternate extrapolation model is more appropriate. Where an alternative extrapolation model has been nationally accepted for use for a hazardous substance by the United States Environmental Protection Agency, this demonstration shall be considered to have been met for that hazardous substance ;

(C) All doses shall be adjusted to give an average daily dose over the study duration; and

(D) An interspecies scaling factor shall be used to take into account differences between animals and humans. For oral carcinogenic toxicity values, this ~~This~~ scaling factor shall be based on the assumption that milligrams per surface area is an equivalent dose between species unless the department determines there is clear and convincing scientific data which demonstrates that an alternate procedure is more appropriate. The slope of the dose response curve for the test species shall be multiplied by this scaling factor in order to obtain the carcinogenic potency factor, except where such scaling factors

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are incorporated into the extrapolation model under (B) of this subsection. The procedure to derive a human equivalent concentration of inhaled particles and gases shall take into account, where available, the respiratory deposition and absorption characteristics of the gases and inhaled particles. Where adequate pharmacokinetic and metabolism studies are available, data from these studies may be utilized to adjust the interspecies scaling factor.

(d) When assessing the potential carcinogenic risk of mixtures of chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans either of the following methods shall be used unless the department determines that there is clear and convincing scientific data which demonstrates that the use of these methods is inappropriate:

(i) The entire mixture is assumed to be as toxic as 2,3,7,8 TCDD. This is generally used when laboratory analyses do not sufficiently distinguish the components of the mixture; or,

(ii) The toxicity equivalency factors and methodology described in: EPA. 1989. "Interim procedures for estimating risks associated with exposure to mixtures of chlorinated dibenzo-p-dioxins and dibenzofurans (CDDs and CDFs) and 1989 update", USEPA, Risk Assessment Forum, Washington, D.C., publication number EPA/625/3-89/016.

(e) When assessing the potential carcinogenic risk of mixtures of polycyclic aromatic hydrocarbons, either of the following methods shall be used unless the department determines that there is clear and convincing scientific data which demonstrates that the use of these methods is inappropriate:

(i) The entire mixture is assumed to be as toxic as benzo(a)pyrene. This is generally used when laboratory analyses do not sufficiently distinguish the components of the mixture; or,

(ii) The toxicity equivalency factors and methodology described in CalEPA. 1994. Benzo(a)pyrene as a toxic air contaminant. Part B: Health Assessment. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Berkeley, CA. When using this methodology, at a minimum, the following compounds shall be analyzed for and included in the calculations: Benzo[a]pyrene, Benz[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Indeno[1,2,3-cd]pyrene. The department may require additional compounds from the CalEPA list to be included in the methodology should site testing data or information from other comparable sites or waste types indicate the additional compounds are potentially present at the site.

(f) In estimating a carcinogenic potency factor for a hazardous substance under (c) of this subsection, the department shall consult with the science advisory board, the department of health, and the United States Environmental Protection Agency and may, as appropriate, consult with other qualified persons. Scientific data supporting such a change shall be subject to the requirements under WAC 173-340-702(15).

(g) Where a carcinogenic potency factor other than that established under (a), (d) and (e) of this subsection is used to establish cleanup levels or remediation levels at individual sites, the department shall summarize the scientific rationale for the use of that value in the cleanup action plan. The department shall provide the opportunity for public review and comment on this value in accordance with the requirements of WAC 173-340-360 and 173-340-600.

(9) Lead toxicity. When assessing the human toxicity of lead contaminated soil, either of the following methods may be used:

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(i) The values for soil lead cleanup provided in tables 740-1 and 745-1, subject to the restrictions on the use of those tables.

(ii) The United States Environmental Protection Agency--Integrated Exposure Uptake Biokinetic Model [IEUBK model] for lead in children, version 0.99d., released February, 1994. When using this model, the following requirements shall apply:

(a) Soil lead cleanup and remediation levels shall be based on a protecting at least 95% of children modeled from having blood lead levels that exceed 0.10 micrograms/deciliter.

(b) The default values provided for in the model and supporting guidance shall be used. Any proposed changes to the default values for exposure assumptions shall comply with subsection (11) of this section.

(iii) Any other methods for calculating soil lead cleanup levels would be considered new scientific information and required to gain approval through WAC 173-340-702.

~~(9)~~ (10) Bioconcentration factors.

(a) For purposes of establishing cleanup levels and remediation levels for a hazardous substance under WAC 173-340-730, a bioconcentration factor established by the United States Environmental Protection Agency and utilized to establish the ambient water quality criterion for that substance under section 304 of the Clean Water Act shall be used. For organic substances, where no value is available from the USEPA, the octanol-water partitioning coefficient may be used as the bioconcentration factor. These methods shall be used unless the department determines that there is clear and convincing adequate scientific data which demonstrates that the use of an alternate value is more appropriate for the conditions present at the site.

(b) When utilizing a bioconcentration factor other than that utilized to establish the ambient water quality criterion, the department shall may, as appropriate, consult with the science advisory board, the department of health, and the United States Environmental Protection Agency. Scientific data supporting such a change shall be subject to the requirements under WAC 173-340-702(15).

(c) Where a bioconcentration factor other than that established under (a) of this subsection is used to establish cleanup levels or remediation levels at individual sites, the department shall summarize the scientific rationale for the use of that factor in the draft cleanup action plan. The department shall provide the opportunity for public review and comment on the value in accordance with the requirements of WAC 173-340-360 and 173-340-600.

~~(10)~~ (11) Exposure parameters.

(a) As a matter of policy, the department has defined in WAC 173-340-720 through 760 the default values for exposure parameters to be used when establishing cleanup levels and remediation levels under this chapter. With the exception of the parameters identified Except as provided for in (b) and (c) of this subsection or and in WAC 173-340-720 through 760, these parameters default values shall not be modified changed for individual hazardous substances or sites. in a manner which results in a less stringent cleanup level. The scientific and technical basis for these parameters shall be reviewed when updating this chapter under WAC 173-340-704(3).

~~_____ (b) The department may approve the use of values other than those specified in WAC 173-340-720 through 173-340-760 where there is clear and convincing scientific data which demonstrates that one or more of the following parameters should be modified for an individual hazardous substance or site:~~

~~_____ (i) Gastrointestinal absorption rate;~~

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- ~~_____ (ii) Inhalation correction factor;~~
- ~~_____ (iii) Bioconcentration factor; or~~
- ~~_____ (iv) Inhalation absorption rate.~~

(b) Exposure parameters that are primarily a function of the exposed population characteristics (such as body weight and lifetime) and those that are primarily a function of human behavior that cannot be controlled through an engineering or institutional control (such as: fish consumption rate; soil ingestion rate; drinking water ingestion rate; and, breathing rate) are not expected to vary on a site by site basis. The default values for these exposure parameters shall not be changed when calculating cleanup levels. For remediation levels the default values for these exposure parameters may only be changed when an alternate reasonable maximum exposure scenario is used, as provided for in WAC 173-340-708(3)(d), that reflects a different exposed population such as using an adult instead of a child exposure scenario. Other exposure parameters may be changed only as follows:

(i) For calculation of cleanup levels, the types of exposure parameters that may be changed are those that are: (A) Primarily a function of reliably measurable characteristics of the hazardous substance, soil, hydrologic or hydrogeologic conditions at the site and, (B) Are not dependent on the success of engineered controls or institutional controls for controlling exposure of persons to the hazardous substances at the site. The default values for these exposure parameters may be changed where there is adequate scientific data to demonstrate that use of an alternative or additional value would be more appropriate for the conditions present at the site. Examples of exposure parameters for which the default values may be changed under this provision are as follows: contaminate leaching and transport variables (such as the soil organic carbon content, aquifer permeability and soil sorption coefficient); inhalation correction factor; fish bioconcentration factor; soil gastrointestinal absorption rate; and, inhalation absorption percentage.

(ii) For calculation of remediation levels, in addition to the exposure parameters that may be changed under paragraph (b)(i) above, the types of exposure parameters that may be changed from the default values are those where a demonstration can be made that the proposed remedy uses engineered controls and/or institutional controls that can be successfully relied on, for the reasonably foreseeable future, to control contaminant mobility and/or exposure to the contamination remaining on the site. In general, exposure parameters that may be changed under this subdivision are those that define the exposure frequency, exposure duration and exposure time. The default values for these exposure parameters may be changed where there is adequate scientific data to demonstrate that use of an alternative or additional value would be more appropriate for the conditions present at the site. Examples of exposure parameters for which the default value changed under this provision are as follows: infiltration rate; frequency of soil contact; duration of soil exposure; duration of drinking water exposure; duration of air exposure; drinking water fraction; and, fish diet fraction.

(c) When the modifications provided for in (b) of this subsection result in significantly higher values for cleanup levels or remediation levels than would be calculated using the default values for exposure parameters, the risk from other potentially relevant pathways of exposure shall be evaluated addressed under the procedures provided for in WAC 173-340-720 through 173-340-760. For exposure pathways and parameters for which default values are not specified in this chapter the framework provided for by this subsection, along with the quality of information

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requirements in (WAC 173-340-702), shall be used to establish appropriate or additional assumptions for these parameters and pathways.

(d) Where the department approves the use of exposure parameters other than those established under WAC 173-340-720 through 173-340-760 to establish cleanup levels or remediation levels at individual sites, the department shall summarize the scientific rationale for the use of those parameters in the cleanup action plan. The department shall provide the opportunity for public review and comment on those values in accordance with the requirements of WAC 173-340-360 and 173-340-600. Scientific data supporting such a change shall be subject to the requirements under WAC 173-340-702(15).

(11) Methods for defining background concentrations.

(a) Sampling of hazardous substances in background areas may be conducted to distinguish site-related concentration from nonsite related concentrations of hazardous substances ~~or to support the development of a method C cleanup level under the provisions of WAC 173-340-706.~~ For purposes of this chapter, two types of background may be determined, natural background and area background concentrations.

(b) For purposes of defining background concentrations, samples shall be collected from areas that have the same basic characteristics as the medium of concern at the site, have not been influenced by releases from the site and, in the case of natural background concentrations, have not been influenced by releases from other localized human activities.

(c) The statistical method used to evaluate available data shall be appropriate for the distribution of each hazardous substance. If the distribution of the hazardous substance data is inappropriate for statistical methods based on a normal distribution, then the data may be transformed. ~~If the distributions of individual hazardous substances differ, more than one statistical method may be required at a site.~~ Sampling data shall be assumed to be lognormally distributed unless it can be demonstrated another distribution is more appropriate. ~~In general, a~~ Appropriate statistical methods include the following:

(i) A tolerance interval procedure in which an interval for each hazardous substance is established from the distribution of background data and the cleanup level of each hazardous substance is compared to the ~~lower~~ upper tolerance limit; and

(ii) Other statistical methods proposed by the person undertaking the cleanup action and approved by the department.

(d) If a tolerance interval approach is used to evaluate natural background data, the tolerance interval shall have a coverage of ninety-five percent and a tolerance coefficient of ninety-five percent. When determining natural background concentrations for soil, sample size of ten or more background soil samples shall be required. When determining area background concentrations for soil, a sample size of twenty or more soil samples shall be required. The number of samples for other media shall be sufficient to provide a representative measure of background concentrations and shall be determined on a case-by-case basis.

(e) For purposes of estimating background concentrations, values below the method detection limit shall be assigned a value equal to one-half of the method detection limit. Measurements above the method detection limit, but below the practical quantitation limit shall be assigned a value equal to the method detection limit. The department may approve the use of alternate statistical procedures for handling data below the method detection limit or practical quantitation limit. Alternate statistical procedures may include probit analysis and regression analysis.

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(12) Significant figures. Risk assessment results shall be presented using rounded to at least one significant figure using standard mathematical rules for rounding.

(13) Probabilistic Risk Assessment. Probabilistic risk assessment methods may be used under this chapter only on an informational basis for evaluating alternative remedies. Such methods shall not be used to replace cleanup standards and remediation levels derived using deterministic methods under this chapter until the department has promulgated rules describing adequate technical protocols and policies for the use of probabilistic risk assessment under this chapter.

(New section) WAC 173-340-709 Ecological evaluation procedures. (1) Purpose. This section defines the goals and procedures that the department will use to establish cleanup levels and support the selection of remedies which are protective of the environment.

(a) Goals. The overall goal of the ecological evaluation process is to protect terrestrial and aquatic species from significant adverse effects. For aquatic species, standards for significance are defined in state water quality and sediment regulations. For terrestrial species, population-level effects related to impaired reproduction, growth or survival are considered significant, except for threatened or endangered species listed under the federal Endangered Species Act or for species other applicable laws. For threatened or endangered species, an adverse impact is "significant" if it causes harm to any individual member of the species or otherwise violates protections provided under the Endangered Species Act or other applicable laws.

(2) Surface water evaluation.

Ecological cleanup standards for surface water other than wetlands shall be established in accordance with WAC 173-340-730.

(3) Wetland evaluation. Ecological cleanup standards for wetlands shall be established in accordance with WAC 173-340-730 and 173-340-760. Ecological cleanup standards for wetland soils that do not meet the definition of sediments (reference to be included) shall be established by the department on a case by case basis.

(4) Sediment evaluation.

Ecological cleanup standards for sediments shall be established in accordance with WAC 173-340-760.

(5) Terrestrial evaluation. A terrestrial evaluation focuses on existing or potential threats from soil contamination to terrestrial species. It does not address other possible ecologically based decisions, such as cleanup standards for soil contamination to protect aquatic species, which would need to be considered separately to complete an ecological evaluation. If Method A soil cleanup levels are used, a terrestrial evaluation is not required unless the site meets any of the following criteria:

(A) The site is located on, or directly adjacent to, property where management or land use plans will maintain or restore areas of natural or semi-natural vegetation. (e.g., greenbelts, forestlands, locally designated environmentally sensitive areas, open space areas managed for wildlife, and some parks or outdoor recreation areas that are not used for intensive sport activities); or

(B) Known occurrence at the site of threatened or endangered species; wildlife species designated by Washington State Department of Fish and Wildlife as a "Priority Species" or "Species of Special Concern", or a plant species listed in the Washington State Department of Natural Resources Natural Heritage Program's "Endangered,

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Threatened, and Sensitive Vascular Plants of Washington" publication **[Note: WACs need to be included here]**; or

(C) The site is located on a property that contains at least ten acres of natural vegetation within 500 feet of the soil contamination, not including vegetation beyond the property boundaries; or

(D) The department determines that the site may present a risk to significant wildlife populations.

For sites where a terrestrial evaluation is conducted, the following procedures shall be used to establish soil cleanup levels and support the selection of remedies that are protective of terrestrial species.

(a) Overview. The terrestrial evaluation is divided into three parts ("tiers"). For many sites, the Tier I evaluation may be sufficient to demonstrate that soil contamination does not present a threat to terrestrial species, and no further evaluation is required. If none of the Tier I criteria for making this demonstration apply, a Tier III terrestrial evaluation shall be conducted if any of the Tier III criteria listed in subsection (5)(b) apply. For a site that does not meet any of the Tier III criteria, a potentially liable person shall conduct either a Tier II or a Tier III terrestrial evaluation. The Tier II procedure is intended to be protective of terrestrial species at most sites, while the site-specific Tier III process for use at ecologically sensitive sites is intended to be highly likely to be protective at any site. It is expected that methods and approaches used in Tier II terrestrial evaluations will be reasonably likely to protect terrestrial species from significant adverse effects. For Tier III terrestrial evaluations, it is expected that the selected methods and approaches will be highly likely to protect terrestrial species from significant adverse effects. Cleanup levels developed in a Tier III terrestrial evaluation need not necessarily be lower than Tier II screening levels provided in Table 6.

(b) Focus of the terrestrial evaluation. Within intensively developed areas of industrial and commercial sites, the focus of the terrestrial evaluation is on the protection of wildlife (terrestrial vertebrates). Within other areas the focus is on protection not only of wildlife but also plants and ecologically important functions of soil biota that support the reproduction, growth or survival of plants and wildlife.

(i) Point of compliance. For Tier II or Tier III terrestrial evaluations, a cleanup level based on the protection of plants or soil biota applies to the biologically active soil zone where these receptors are exposed to the soil contamination. Unless the department determines otherwise, a cleanup level based on protection of wildlife applies to the biologically active zone where food plants or soil-associated prey species are exposed to contaminants. The following is an example of a situation where the department might establish a deeper pointer of compliance: For a Tier III terrestrial evaluation where protection of burrowing animals is identified as a site-specific concern, the department may establish a point of compliance cleanup level deeper than the biologically active zone at a reasonable maximum depth of exposure for burrowing animals likely to occur at the site.

(c) Tier I. Unless Ecology determines that special circumstances exist that require a more detailed evaluation, the terrestrial evaluation need not proceed further if any of the criteria described in Table 4 are met.

(d) Criteria for conducting Tier II or Tier III terrestrial evaluations of soil contamination. For sites that do not meet any of the Tier I criteria described in Table 4, either a Tier II or a Tier III terrestrial evaluation shall be conducted. A Tier III terrestrial evaluation, as described in subsection (5)(f) of this section, shall be conducted if any of the criteria listed in subsection (5)(d)(i) of this section are met. If none of the criteria are met, a potentially liable

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person may elect to conduct either a voluntary Tier III terrestrial evaluation or a Tier II terrestrial evaluation.

(i) Tier III criteria. A site-specific terrestrial evaluation is required if any of the following conditions apply:

(A) The site is located on, or directly adjacent to, property where management or land use plans will maintain or restore areas of natural or semi-natural vegetation. (e.g., greenbelts, forestlands, locally designated environmentally sensitive areas, open space areas managed for wildlife, and some parks or outdoor recreation areas that are not used for intensive sport activities); or

(B) Known occurrence at the site of threatened or endangered species; wildlife species designated by Washington State Department of Fish and Wildlife as a "Priority Species" or "Species of Special Concern", or a plant species listed in the Washington State Department of Natural Resources Natural Heritage Program's "Endangered, Threatened, and Sensitive Vascular Plants of Washington" publication; or

(C) The site is located on a property that contains at least ten acres of natural vegetation within 500 feet of the soil contamination, not including vegetation beyond the property boundaries; or

(D) The department determines that the site may present a risk to significant wildlife populations.

(e) Tier II terrestrial evaluation. The Tier II evaluation process includes several steps. Subsection (i) provides criteria for demonstrating that soil contamination does not present a potential threat to terrestrial receptors subsection. For sites that do not meet any of these criteria, subsections (ii) and (iii) describes procedures for developing cleanup levels. (Note: the Tier II evaluation procedure is intended to expedite decision-making at the majority of sites that do not meet any of the Tier I criteria in Table 4. The procedure is not intended to be appropriate in all circumstances. If there are special considerations that justify an alternative approach, a potentially liable person should consider conducting a voluntary Tier III terrestrial evaluation in consultation with the department as provided for in subsection (5)(f) of this section.)

(i) Unless Ecology determines that special circumstances exist that require a more detailed evaluation, no further ecological evaluation of soils is required if any of the following criteria are met:

(A) The ecological exposure area is less than criteria provided in Table 5; or

(B) There are no potential exposure pathways from the soil contamination to soil biota, plants or wildlife. For a commercial or industrial property, only potential exposure pathways to wildlife (e.g., small mammals, birds) need be considered.

(C) The area of soil contamination is not more than 350 square feet.

(D) The soil contamination does not include any of the substances listed in Table 6 at concentrations higher than the indicated screening levels, using the statistical methods described in subsection 173-340-740(7).

(ii) For sites that do not meet any of the Tier II criteria listed in subsection 173-340-709(5)(e)(i), a potentially liable person may elect to use Tier II screening levels listed in Table 6 as cleanup levels. Alternatively, methods approved by the department may be used in place of Tier II screening levels to establish site-specific cleanup levels. A potentially liable person may also elect to conduct a voluntary Tier III terrestrial evaluation in consultation with the department, described in 173-340-709(5)(f). (See (5)(f)(iii)(H).)

(iii) Site-specific cleanup levels. For a commercial or industrial property a site-specific cleanup level is a soil concentration established for the protection of wildlife from

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significant adverse effects. For other land uses, a site-specific cleanup level is a soil concentration established for the protection of wildlife, plants and soil biota from significant adverse effects. Where an effects-based approach such as bioassay testing is used, areas of soil contamination failing the test may be defined in place of chemical concentrations.

(iv) Institutional controls. Use of Tier II criteria listed in (ii)(B) requires the application of institutional controls to prevent future exposure of terrestrial receptors to soil contamination. Alternatively, soils may be cleaned to cleanup levels established using any of the options described in subsection 173-340-709(5)(e)(ii). Cleanup remedies that rely on Tier II screening levels for industrial/commercial sites shall include appropriate institutional controls to prevent future exposure to plants or soil biota in the event of a change in land use. To eliminate the requirement for institutional controls, alternatives include remediating to Tier II screening levels for unrestricted land use, or to site-specific cleanup levels developed in Tier II or Tier III.

(f) Tier III terrestrial evaluation of soil contamination.

(i) Expectations. Tier III terrestrial evaluations are intended for use at sites where a more careful assessment than for Tier II is required. The following apply to Tier III terrestrial evaluations:

(A) Tier III terrestrial evaluations may not be based on Tier II screening levels. Tier II screening values are developed from less conservative assumptions than are acceptable for Tier III sites. Cleanup levels developed in a Tier III terrestrial evaluation may be higher or lower than Tier II screening levels, depending on site-specific considerations, such as contaminant toxicity or bioavailability.

(B) The approach and methods to be used shall be developed in consultation and with the approval of the department. The use of assessment and measurement endpoints, as defined in USEPA *Ecological Risk Assessment Guidance for Superfund*, 1997, should be considered to clarify the logical structure of the evaluation. Assessment endpoints shall be consistent with the policy objectives described in 173-340-709(1) and 173-340-709(5).

(C) Where Tier III terrestrial evaluations involve qualitative decisions based on professional judgment and experience, the department expects persons conducting a Tier III terrestrial evaluation to have relevant academic training in the biological sciences, such as ecology and toxicology, and previous experience in conducting site-specific terrestrial ecological risk assessments.

(ii) Problem formulation step. The scope and focus of a Tier III terrestrial evaluation should be designed to provide information needed for the remedy selection process described in WAC 173-340-362 through 173-340-366. Examples of potential information include:

- Whether soil contamination may present a significant risk to terrestrial ecological receptors;
- Site-specific ecologically-based cleanup levels or, in an effects-based approach, areas of soil contamination requiring remediation;
- Ecological protectiveness of a remedial design to be included in the remedy selection evaluation;
- Expected ecological recovery time frame following remediation.

Preliminary remedial information, such as measures that will be taken for the protection of human health, may be considered, if available, in limiting the scope of problems to be addressed by the evaluation. The scope and focus of a Tier III terrestrial

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evaluation shall be determined on a site-specific basis in consultation and with the approval of the department. In defining the problems to be addressed by the evaluation, the department will, at a minimum, consider the following:

(A) Whether sufficient soil sampling data are available to conduct a Tier III terrestrial evaluation;

(B) Information obtained from a site inspection conducted by the department;

(C) Whether all existing and potential exposure pathways for ecological receptors at the site are identified in a conceptual site model;

(D) Whether the set of contaminants of potential ecological concern has been adequately identified for the site;

(E) The sensitivity of different existing and potential ecological receptors to the contaminants.

(F) Public concerns.

(G) Whether remedial plans for the site based on protection of human health or other considerations will leave residual soil contamination that may potentially present a risk of significant adverse effects to terrestrial species.

(H) Whether the soil contamination may potentially present a significant risk to a threatened or endangered species.

(iii) Selection of ecological indicator hazardous substances. When conducting a Tier III terrestrial evaluation at a site that is contaminated with numerous hazardous substances, a potentially liable person may narrow the focus of the evaluation to a smaller set of ecological indicator hazardous substances. If the department considers this approach appropriate for a particular site, the factors evaluated when eliminating individual hazardous substances from further consideration in the evaluation shall include the following:

(A) Where the maximum or the 95% upper confidence limit soil concentration of a hazardous substance does not exceed chemical indicator concentrations for the protection of plants, soil biota or wildlife, a potentially liable person may eliminate the substance from consideration in the evaluation. For plants and soil biota, chemical indicator concentrations are those listed in Table 6a. For chemicals that are not listed, chemical indicator concentrations shall be established using the methods described in WAC 173-340-709(5)(j) and in accordance with (5)(f)(v)(C) and (5)(f)(v)(D). For wildlife, chemical concentrations calculated using the wildlife exposure model described in (5)(f)(v)(A) shall be used as chemical indicator concentrations. Caution on the use of chemical indicator concentrations for effects on plants and soil biota: These numbers are not cleanup levels, and exceedances do not necessarily require further action. A chemical indicator concentration that is below the natural background concentration may be set at the natural background concentration.

(B) The spatial distribution of concentrations of a hazardous substance exceeding concentrations established under subsections 173-340-(5)(f)(v)(A) are so limited that risks to terrestrial species are clearly insignificant. Possible reasons for retaining chemicals from such areas as contaminants of potential ecological concern could include: high concentrations present; potential for acute toxicity to wildlife; potential for the chemical to contaminate a larger area over time if unremediated (mobility); potential for the chemical to bioaccumulate.

(C) The hazardous substances is infrequently detected in soil samples (e.g., <5% of samples). The question of whether a detection may have come from a larger, unsampled area of contamination shall be considered in applying this criterion. Additional

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sampling to resolve this issue may be appropriate if the detection indicates a high concentration of the chemical, or the chemical bioaccumulates.

(D) It is known that the contaminant is limited to an area that will be remediated (e.g., based on groundwater protection, risks to human health, etc.). Where there is early mutual agreement with the department that some areas of soil contamination will require remediation, it may be possible to use this information to narrow the list of ecological indicator hazardous substances. However, the substances thus eliminated should be retained for discussion in the terrestrial evaluation report.

(F) There is a high spatial correlation with another hazardous substance of greater ecological concern that can serve as a surrogate for remedial decisions.

(G) Whether a substance is present at concentrations above natural background. Area background may not be used to eliminate a hazardous substance as a contaminant of potential ecological concern. However, area background may be considered in the selection of a cleanup action (WAC 173-340-360(6)(c)).

() Essential nutrient concentrations (to be completed).

(H) For a site where a potentially liable person conducts a voluntary Tier III terrestrial evaluation as provided for in subsection 173-340-709(5)(e)(ii) of this section, contaminants of ecological concern are the hazardous substances present in soil at concentrations above the values shown in Table 6.

(I) Short-lived pesticides are not considered candidate contaminants of potential ecological concern if it can be shown through application records or other information that they have been properly applied in conformance with applicable label directions, laws and regulations

(iv) Site-specific approach. Following completion of the problem formulation phase of the Tier III terrestrial evaluation, an appropriate approach for addressing issues identified in the problem formulation phase shall be developed. The approach shall be developed in consultation and with the approval of the department. A record of the selected approach and the basis for the selection shall be prepared and made available to the public upon request. A site-specific approach may include, but need not be limited to, any of the following:

(A) The department may conclude that there is already sufficient information available to develop a cleanup remedy that is adequately protective of terrestrial ecological receptors.

(B) Based on an evaluation of the potentially affected ecological receptors, habitats and ecological communities potentially at risk, the department may agree to a request to conduct a Tier II terrestrial evaluation at the site;

(C) A Level 1 (screening) approach may be used, as described in subsection (5)(f)(v), or a Level 2 approach may be used, as described in subsection (5)(f)(vi). A potentially liable person who elects to use a Level 1 approach may also conduct a further evaluation using a Level 2 approach.

(v) Level 1 (screening) approaches. A Level 1 evaluation may be used to determine that a site does not present a significant risk to terrestrial receptors. If results of the evaluation do not support such a determination, a potentially liable person may elect to use results from the evaluation for remedy decisions. Alternatively, the potentially liable person may elect to conduct a Level 2 evaluation. A Level 1 evaluation uses approaches that are more rapid and less expensive than those used in a Level 2 evaluation. A potentially liable person may elect to use criteria such as biomarker effects that serve as sensitive surrogates for adverse effects on populations but that are not direct indicators of

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adverse effects on populations.. Because Level 1 approaches require limited site-specific information, conservative assumptions shall be used that would be protective under reasonable worst-case situations. Level 1 approaches to be used shall be selected in consultation and with the approval of the department and may include the following:

(A) Wildlife exposure model. Soil concentrations that are protective of wildlife shall be established using the wildlife exposure model described in Table 7. The department may identify additional wildlife receptors to be included in the model on a site-specific basis, such as: locally-occurring native species known to be particularly sensitive to a contaminant of potential ecological concern; species identified by the public as a site-specific concern; legally protected species likely to occur at, or visit, the site. Some potential exposure pathways are not included in Table 7 (e.g., inhalation, dermal contact). The department may require that an evaluation of risks through these or other pathways be included in the problem formulation if appropriate on a site-specific basis.

(B) Soil concentrations protective of soil biota or plants. Screening levels shall be established from a literature survey conducted in accordance with (5)(f)(iv)(C) and (5)(f)(iv)(D). Alternatively, a potentially liable person may elect to use the chemical indicator selection concentrations described in (5)(f)(iii)(A) as screening levels.

(C) Literature survey. Literature surveys shall be thorough, critical and objective. The use of a commercial literature search service is an effective method for conducting a thorough survey. The department may also identify relevant articles, books or other documents that shall be included in the survey. A list of relevant journals and other literature included in the survey shall be provided to the department. A tabular summary of information from all relevant studies shall be provided to the department in a report, and the studies used to select a proposed value shall be identified. Copies of literature cited in the table that are not in the possession of the department shall be provided with the report. Appropriately conservative selections shall be used (e.g., lowest relevant LOAEL found in the literature).

(D) Toxicity reference values or screening concentrations established from the literature shall represent the lowest relevant LOAEL found in the literature. Bioaccumulation factor values shall represent a reasonable maximum value from relevant information found in the literature. In assessing relevance, the following principles shall be considered:

- Literature screening values shall be obtained from bioassays having test conditions as similar as possible to site conditions.
- The literature benchmark values or toxicity reference values should correspond to the exposure route being assessed.
- The toxicity reference value or bioaccumulation factor value shall be as appropriate as possible for the receptor being assessed. The toxicity reference value should be based on a significant endpoint, as described in subsection (1)(a).
- The literature screening value or toxicity reference value should preferably correspond to the appropriate exposure duration period (subchronic or chronic).
- The literature screening value, toxicity reference value or bioaccumulation factor should preferably correspond to the chemical form being assessed. Exceptions may apply for toxicity reference values where biological transformations occur following uptake of the chemical.

(E) Soil bioassays. Level 1 bioassays may use sensitive surrogate organisms not necessarily found at the site provided that the test adequately addresses the concerns

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raised in the problem formulation step. For sites where risks to plant life are a concern, the test described in *Early Seedling Growth Protocol for Soil Toxicity Screening*. Ecology Publication No. 96-324 may be used. For sites where risks to soil biota are a concern, the test described in *Earthworm Bioassay Protocol for Soil Toxicity Screening*. Ecology Publication No. 96-327 may be used. Other bioassay tests approved by the department may also be used.

(F) Biomarker methods may be approved by the department if the measurements have clear relevance to issues raised in the problem formulation and the approach has a high probability of detecting an adverse effect if it is occurring at the site.

(G) Other methods approved by the department.

(vi) Level 2 approaches. Level 2 approaches involve the collection of more site-specific information than for Level 1. The use of Level 2 approaches is voluntary. A potentially liable person may elect to base the Tier III evaluation results of a Level 1 evaluation alone or to proceed to Level 2. Level 2 approaches to be used shall be selected in consultation and with the approval of the department and may include the following:

(A) Wildlife exposure model. Default values for the wildlife exposure model described in Table 7 may be replaced with values obtained from site-specific empirical studies to evaluate the toxicity or bioavailability of soil contaminants.

(B) Soil concentrations protective of soil biota or plants may be established using Level 2 soil bioassays.

(C) Soil bioassays. Level 2 bioassays should use species ecologically relevant to the site rather than standard test species used in a Level 1 bioassay evaluation. Species that do or could occur at the site are considered ecologically relevant.

(D) Site-specific field studies. Site-specific empirical studies that involve hypothesis testing should follow conventional statistical methods for data analysis. A conventional “no difference” null hypothesis should be developed (e.g., H_0 : earthworm densities are the same in the contaminated area and the reference (control) area. H_A : earthworm densities are higher in the reference area than in the contaminated area.) In preparing a work plan, consideration shall be given to the adequacy of the proposed study to detect an ongoing adverse effect and this issue shall be addressed in reporting results from the study.

(E) Other site-specific methods approved by the department. The department encourages proposals for the use of new and innovative empirical methods. If approved, this information shall be made available by the department to interested persons.

(F) Uncertainty analysis. Discussion of uncertainty shall identify and differentiate between uncertainties that can and cannot be quantified, and natural variability. The discussion shall describe the range of potential ecological risks from the hazardous substances present at the site, based on the toxicological characteristics of the hazardous substances present, and evaluate the uncertainty regarding these risks. Potential methods for reducing uncertainty shall also be discussed, such as additional studies or post-remedial monitoring. If multiple lines of independent evidence have been developed, a weight of evidence approach may be used in characterizing uncertainty. A weight of evidence approach shall include a balance in the application of literature, field, and laboratory data, recognizing that each has particular strengths and weaknesses. Site-specific data shall be given greater weight than default values or assumptions where appropriate.

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(g) The department shall consider proposals for modifications to default values provided in this section based on new scientific information in accordance with WAC 173-340-702(14).

(h) Substitutions of receptor species in the wildlife exposure model described in Table 7 may be made subject to the following conditions:

(A) There is scientifically supportable evidence that a receptor identified in Table 7 is not characteristic of the ecoregion where the site is located.

(B) The proposed substitute receptor is characteristic of the ecoregion where the site is located and will serve as a surrogate for wildlife species that are, or may become exposed to soil contamination at the site. The selected surrogate shall be a species that is expected to be vulnerable to the effects of soil contamination relative to the current default species because of high exposure or known sensitivity to chemicals found in soil at the site.

(C) Scientific studies concerning the proposed substitute receptor species are available in the literature to select reasonable maximum exposure estimates for variables listed in Table 7.

(D) In choosing among potential substitute receptor species that meet the criteria in (B) and (C), preference shall be given to the species most ecologically similar to the default receptor being replaced.

(E) Unless there is clear and convincing evidence that they are not characteristic of the ecoregion where the site is located, the following groups shall be included in the wildlife exposure model: a small mammalian predator on soil-associated invertebrates, a small avian predator on soil-associated invertebrates, and a small mammalian herbivore.

(F) If screening levels calculated using the modified wildlife exposure model exceed those calculated using the default model described in Table 7, the ecological evaluation report shall include an assessment of whether it is biologically reasonable to expect such a difference.

(i) Changes to the list of Tier II Priority Contaminants of Ecological Concern. The department may add or delete a chemical from the list of Tier II Priority Contaminants of Ecological Concern provided in Table 6 after a thorough review of information from previous site investigations and consideration of the following:

(A) Whether the chemical been detected in contaminated soil.

(B) Whether the chemical has consistently been found only at concentrations well below the Tier II screening concentrations, and are there technically defensible reasons for concluding that the chemical is very unlikely to occur at higher concentrations at contaminated sites in Washington state.

(C) Whether there is a suitable surrogate chemical available on the current list.

(D) Whether there is reliable evidence that the chemical has not been manufactured, sold, or used in Washington state.

(E) Whether there is convincing evidence from a review of the results from ecological evaluations conducted in Washington state that the chemical does not pose a threat to the environment at soil concentrations below those established for the protection of human health. In making this determination, Ecology will consider the number and quality of the ecological evaluations conducted for this chemical and whether a soil concentration established in a future site-specific human health risk assessment might not be environmentally protective.

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(F) Whether the addition is needed to correct a deficiency in the overall environmental protectiveness of the Tier II terrestrial evaluation process.

(G) Whether there is sufficient information to provide a basis for developing Tier II screening concentrations and whether the chemical meets at least one of the following criteria:

- Highly persistent in the environment; or
- High potential for bioaccumulation in the environment; or
- High toxicity to wildlife.

(H) The department will provide notice in the site register that it is considering adding or deleting a chemical from the Tier II Priority Contaminants List. Interested parties may submit technical information (e.g., toxicological studies from the peer-reviewed scientific literature) for the agency to consider in consultation with the Model Toxics Control Act Science Advisory Board.

(j) Methods for calculating chemical indicator concentrations based on protection of plants or soil invertebrates. If there are 10 or fewer LOAEL values available for a chemical, the lowest LOAEL shall be used as the indicator concentration. If there are more than 10 values available, the 10th percentile LOAEL value estimated with nonparametric statistical methods shall be used as the indicator concentration. When a chemical indicator concentration is based on an LC₅₀ or on some other endpoint that includes a 50% or greater reduction in survivorship, the value shall be divided by a factor of 5. Chemical indicator concentrations shall be rounded down to one significant figure.

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Table 4
Tier I Ecological Evaluation of Soil

The following criteria apply to existing conditions at the time of site discovery and reporting (WAC 173-340-300). They should not be used for remedial decisions, which are subject to requirements in WAC 173-340-360.

1)

a. Does the soil contamination include any of the following substances listed below?^a

Chlorinated dioxins or furans
PCB mixtures (polychlorinated biphenyls)
DDT, DDE or DDD
Aldrin
Chlordane
Dieldrin
Endosulfan
Endrin
Heptachlor
Benzene hexachloride
Toxaphene
Hexachlorobenzene
Pentachlorophenol
Pentachlorobenzene

If “no”, proceed to 1b).

If “yes” or “don’t know” proceed to line 2).

b. Is there less than 1.5 acres of contiguous undeveloped land^b within 500 feet of the area of contamination?

If “yes”, no further evaluation is required.

If “no”, or “don’t know” proceed to line 2).

2) Is all of the soil contamination at least 6 feet below the soil surface?

If “yes”, no further evaluation is required.

If a further evaluation is not conducted, institutional controls may be needed to ensure that the contamination will remain at least 6 feet below the soil surface (see WAC 173-340-440).

If “no”, or “don’t know” proceed to line 3).

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- 3) Is all of the soil contamination covered by existing buildings, roads or pavement to preclude exposure by plants or wildlife to the contaminated soil?
- If “yes”, no further evaluation is required.
If a further evaluation is not conducted, institutional controls may be needed to ensure that the exposure barrier continues to remain in place (see WAC 173-340-440).
If “no”, or “don’t know” proceed to line 4).
- 4) Are there other existing physical barriers that prevent plants and wildlife from being exposed to the soil contamination?
- If “yes”, no further evaluation is required.
If a further evaluation is not conducted, institutional controls may be needed to ensure that the exposure barriers continue to remain effective (see WAC 173-340-440).
If “no”, a further evaluation is required (WAC 173-340-709(5)(d)).

^a This list does not imply that sampling must be conducted for each of these chemicals at every site. Sampling should be conducted for those chemicals that might be present based on available information, such as current and past uses of chemicals at the site.

^b “Undeveloped land” means land that is not covered by existing buildings, roads, paved areas or other physical barriers that would prevent wildlife from feeding on plants, earthworms, insects or other food in or on the soil.

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Table 5
Tier II Ecological Evaluation of soil - Habitat calculation ^a

1) Estimate the area of undeveloped land to the nearest 1/2 acre (1/4 acre if the area is small). From the table below, find the number of points corresponding to the area and enter this number in this box.																					
<table border="1"> <thead> <tr> <th>Area (acres)</th> <th>Points</th> </tr> </thead> <tbody> <tr> <td>0.25 or less</td> <td>4</td> </tr> <tr> <td>0.5</td> <td>5</td> </tr> <tr> <td>1.0</td> <td>6</td> </tr> <tr> <td>1.5</td> <td>7</td> </tr> <tr> <td>2.0</td> <td>8</td> </tr> <tr> <td>2.5</td> <td>9</td> </tr> <tr> <td>3.0</td> <td>10</td> </tr> <tr> <td>3.5</td> <td>11</td> </tr> <tr> <td>4.0 or more</td> <td>12</td> </tr> </tbody> </table>	Area (acres)	Points	0.25 or less	4	0.5	5	1.0	6	1.5	7	2.0	8	2.5	9	3.0	10	3.5	11	4.0 or more	12	
Area (acres)	Points																				
0.25 or less	4																				
0.5	5																				
1.0	6																				
1.5	7																				
2.0	8																				
2.5	9																				
3.0	10																				
3.5	11																				
4.0 or more	12																				
2) Is this is an industrial or commercial property? (Yes = 3, No = 1)																					
3) Enter a score for the habitat quality of the undeveloped land, using the rating system shown below ^b . (High = 1, Intermediate = 2, Low = 3)																					
4) Is the undeveloped land likely to attract wildlife? (Yes = 1, No = 2) ^c																					
5) Are there any of the following soil contaminants present: chlorinated dioxins/furans, PCB mixtures, DDT, DDE, DDD, aldrin, chlordane, dieldrin, endosulfan, endrin, heptachlor, benzene hexachloride, toxaphene, hexachlorobenzene, pentachlorophenol, pentachlorobenzene? (Yes = 1, No = 4)																					
6) Add the numbers from lines 2 through 5. If line 6 is larger than line 1, the ecological exposure area is below the criterion value (see 173-340-709(5)(e)(i)(A)).																					

^a This analysis applies to contiguous undeveloped land (include contaminated soil on undeveloped land and undeveloped land within 500 feet of the soil contamination). "Undeveloped land" means land that is not covered by existing buildings, roads, paved areas or other barriers that will prevent wildlife from feeding on plants, earthworms, insects or other food in or on the soil. It is expected that these assessments will be undertaken by a qualified field biologist. If this is not the case, enter a conservative score (1) for each of these questions.

^b Habitat rating system. Rate the quality of the habitat as high, intermediate or low based on your professional judgment as a field biologist. The following are suggested factors to consider in making this evaluation:

Low: Bare soil or early successional vegetative stands; vegetation predominantly noxious, nonnative, exotic plant species or weeds. Areas severely disturbed by human activity, including intensively cultivated croplands. Areas isolated from other habitat used by wildlife.

High: Area is ecologically significant for one or more of the following reasons: Late-successional native plant communities present; relatively high species diversity; used by an uncommon or rare species; priority habitat (as defined by the Washington Department of Fish and Wildlife); part of a larger area of habitat where size or fragmentation may be important for the retention of some species.

Intermediate: Area does not rate as either high or low.

^c Indicate "yes" if the area attracts wildlife or is likely to do so. Examples: birds frequently visit the area to feed; evidence of high use by mammals (tracks, scat, etc.); habitat "island" in an industrial area; unusual features of an area that make it important for feeding animals; heavy use during seasonal migrations.

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Table 6
Tier II Priority Contaminants of Ecological Concern

Priority contaminant	Tier II screening level (mg/kg) (unrestricted land use).	Industrial/commercial Tier II screening level (mg/kg).
METALS:		
Antimony		
Arsenic III	20 mg/kg	20 mg/kg
Arsenic V	95 mg/kg	260 mg/kg
Barium		
Beryllium		
Cadmium	25 mg/kg	36 mg/kg
Chromium III	135 mg/kg	135 mg/kg
Chromium VI	48 mg/kg	135 mg/kg
Cobalt		
Copper	140 mg/kg	550 mg/kg
Lead	220 mg/kg	220 mg/kg
Magnesium		
Manganese		
Mercury, inorganic	9 mg/kg	9 mg/kg
Mercury, organic	0.6 mg/kg	0.6 mg/kg
Molybdenum		
Nickel	140 mg/kg	1,850 mg/kg
Silver		
Tin		
Vanadium		
Zinc	270 mg/kg	570 mg/kg
OTHER CHEMICALS:		
Selenium	0.8 mg/kg	0.8 mg/kg
D-n-butyl phthalate		
Bis (2-ethylhexyl) phthalate		
Benzo(a)pyrene	30 mg/kg	300 mg/kg
Acenaphthene		

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PESTICIDES:

Aldicarb/aldicarb sulfone		
Aldrin	0.17 mg/kg	0.17 mg/kg
Carbofuran		
Chlordane		
Chlorpyrifos/chlorpyrifos-methyl		
DDT/DDD/DDE	1 mg/kg	1 mg/kg
Dieldrin	0.17 mg/kg	0.17 mg/kg
Endosulfan		
Endrin		
Heptachlor/heptachlor epoxide	0.6 mg/kg	0.6 mg/kg
BHC (incl. lindane)	3 mg/kg	3 mg/kg
Parathion/methyl parathion		
Toxaphene		
Hexachlorobenzene		
Pentachlorophenol	11 mg/kg	11 mg/kg

OTHER CHLORINATED ORGANICS:

PCBs	2 mg/kg	2 mg/kg
Dioxins	5E-06 mg/kg	5E-06 mg/kg
Chlorinated dibenzofurans	3E-06 mg/kg	3E-06 mg/kg
Pentachlorobenzene		
Hexachlorophene		

PETROLEUM:

TPH (gasoline)	100 mg/kg	100 mg/kg
TPH (diesel)	200 mg/kg	200 mg/kg

^a Caution on misusing Tier II screening levels. These values have been developed for use at sites that do not meet any of the Tier I criteria but where a more careful site-specific Tier III terrestrial evaluation is not required. They are not intended to provide conservative concentrations that would be protective of terrestrial ecological receptors at every site. Exceedances of the values in this table do not necessarily trigger requirements for cleanup action under this chapter. The table is not intended for purposes such as evaluating sludges or wastes.

This list does not imply that sampling must be conducted for each of these chemicals at every site. Sampling should be conducted for those chemicals that might be present based on available information, such as current and past uses of chemicals at the site.

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Table 6a
Tier III Chemical Indicator Concentrations (mg/kg) for
Protection of Plants and Soil Biota ^a

Chemical	Plants ^b	Soil biota ^c
METALS:		
Aluminum (soluble salts)	50	
Antimony	5	
Arsenic	10	60
Barium	500	
Beryllium	10	
Boron	0.5	
Bromine	10	
Cadmium	4	20
Chromium	48 ^d	48 ^d
Cobalt	20	
Copper	100	50
Fluorine	200	
Iodine	4	
Lead	50	500
Lithium	35 ^d	
Manganese	1,100 ^d	
Mercury	0.3	0.1
Molybdenum	2	
Nickel	30	200
Selenium	1	70
Silver	2	
Technetium	0.2	
Thallium	1	
Tin	50	
Uranium	5	
Vanadium	2	
Zinc	86 ^d	200
ORGANICS:		
1,2,3,4-Tetrachlorobenzene		10
1,2,3-Trichlorobenzene		20
1,2,4-Trichlorobenzene		20
1,2-Dichloropropane		700
1,4-Dichlorobenzene		20
2,3,4,5-Tetrachlorophenol		20
2,3,5,6-Tetrachloroaniline	20	20
2,4,5-Trichloroaniline	20	20
2,4,5-Trichlorophenol	4	9
2,4,6-Trichlorophenol		10
2,4-Dichloroaniline		100

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2,4-Dinitrophenol	20	
3,4-Dichloroaniline		20
3,4-Dichlorophenol	20	20
3-Chloroaniline	20	30
3-Chlorophenol	7	10
4-Nitroaniline	40	
4-Nitrophenol		7
Acenaphthene	20	
Biphenyl	60	
Chloroacetamide		2
Chlorobenzene		40
Diethylphthalate	100	
Dimethylphthalate		200
Fluorene		30
Furan	600	
Hexachlorocyclopentadiene	10	
Nitrobenzene		40
N-nitrosodiphenylamine		20
PCBs	40	
Pentachloroaniline		100
Pentachlorobenzene		20
Pentachlorophenol	3	4
Phenol	70	30
Styrene	300	
Toluene	200	

^a Caution on misusing Tier III chemical indicator concentrations for protection of plants and soil biota. These values have been developed for use in conjunction with chemical indicator concentrations for protection of wildlife to identify soil contaminant levels that need not be further considered in a Tier III terrestrial evaluation. The table is not intended for purposes such as evaluating sludges or wastes. Exceedances of the values in this table do not necessarily trigger requirements for cleanup action under this chapter. Natural background concentrations may be substituted for Tier III chemical indicator concentrations for protection of plants, soil biota or wildlife.

This list does not imply that sampling must be conducted for each of these chemicals at every site. Sampling should be conducted for those chemicals that might be present based on available information, such as current and past uses of chemicals at the site.

^b Based on benchmarks published in *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision*, Oak Ridge National Laboratory, 1997.

^c Based on benchmarks published in *Toxicological Benchmarks for Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process*, Oak Ridge National Laboratory, 1995.

^d Benchmark replaced by Washington state natural background concentration.

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Table 7
Wildlife exposure model for Tier III screening level evaluations^a

PLANT

K_{Plant} Plant uptake coefficient (dry weight basis)
Units: $\text{mg kg}^{-1} \text{ plant/mg kg}^{-1} \text{ soil}$
Value: chemical-specific (see Table 8)

SOIL BIOTA

Surrogate receptor: Earthworm

BAF_{Worm} Earthworm bioaccumulation factor (dry weight basis)
Units: $\text{mg kg}^{-1} \text{ worm/mg kg}^{-1} \text{ soil}$
Value: chemical-specific (see Table 8)

MAMMALIAN PREDATOR

Surrogate receptor: Shrew (*Sorex*)

$P_{\text{SB (shrew)}}$ Proportion of contaminated food (earthworms) in shrew diet
Units: unitless
Value: 0.50

$\text{FIR}_{\text{Shrew,DW}}$ Food ingestion rate (dry weight basis)
Units: $\text{kg dry food/kg body weight - day}$
Value: 0.45

$\text{SIR}_{\text{Shrew,DW}}$ Soil ingestion rate (dry weight basis)
Units: $\text{kg dry soil/kg body weight - day}$
Value: 0.0045

$\text{RGAF}_{\text{Soil, shrew}}$ Gut absorption factor for a hazardous substance in soil expressed relative to the gut absorption factor for the hazardous substance in food.
Units: unitless
Value: chemical-specific (see Table 8)

T_{Shrew} Toxicity reference value for shrew
Units: mg/kg - day
Value: chemical-specific (see Table 8)

Home range 0.1 acres

AVIAN PREDATOR

Surrogate receptor: American robin (*Turdus migratorius*)

$P_{\text{SB (Robin)}}$ Proportion of contaminated food (soil biota) in robin diet
Units: unitless
Value: 0.52

$\text{FIR}_{\text{Robin,DW}}$ Food ingestion rate (dry weight basis)
Units: $\text{kg dry food/kg body weight - day}$

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Value: 0.207

$SIR_{Robin,DW}$ Soil ingestion rate (dry weight basis)
Units: kg dry soil/kg body weight - day
Value: 0.0215

$RGAF_{Soil, robin}$ Gut absorption factor for a hazardous substance in soil expressed relative to the gut absorption factor for the hazardous substance in food.
Units: unitless
Value: chemical-specific (see Table 8)

T_{Robin} Toxicity reference value for robin
Units: mg/kg - day
Value: chemical-specific (see Table 8)

Home range 0.6 acres

MAMMALIAN HERBIVORE

Surrogate receptor: Vole (*Microtus*)

$P_{Plant, vole}$ Proportion of contaminated food (plants) in vole diet
Units: unitless
Value: 1.0

$FIR_{Vole,DW}$ Food ingestion rate (dry weight basis)
Units: kg dry food/kg body weight - day
Value: 0.315

$SIR_{Vole,DW}$ Soil ingestion rate (dry weight basis)
Units: kg dry soil/kg body weight - day
Value: 0.0079

$RGAF_{Soil, vole}$ Gut absorption factor for a hazardous substance in soil expressed relative to the gut absorption factor for the hazardous substance in food.
Units: unitless
Value: chemical-specific (see Table 8)

T_{Vole} Toxicity reference value for vole
Units: mg/kg - day
Value: chemical-specific (see Table 8)

Home range 0.08 acres

TIER III SCREENING LEVEL SOIL CONCENTRATIONS FOR WILDLIFE^b

(1) MAMMALIAN PREDATOR:

$$SL_{MP} = (T_{Shrew}) / [(FIR_{Shrew,DW} \times P_{SB(shrew)} \times BAF_{Worm}) + (SIR_{Shrew,DW} \times RGAF_{Soil, shrew})]$$

(2) AVIAN PREDATOR:

$$SL_{AP} = (T_{Robin}) / [(FIR_{Robin,DW} \times P_{SB(Robin)} \times BAF_{Worm}) + (SIR_{Robin,DW} \times RGAF_{Soil, robin})]$$

(3) MAMMALIAN HERBIVORE:

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$$SL_{MH} = (T_{Vole}) / [(FIR_{Vole,DW} \times P_{Plant, vole} \times K_{Plant}) + (SIR_{Vole,DW} \times RGA_{F_{Soil, vole}})]$$

- ^a Substitutions for default receptors may be made as provided for in 173-340-709(5)(g). If a substitute species is used, the values for food and soil ingestion rates, and proportion of contaminated food in the diet, may be modified to reasonable maximum exposure estimates for the substitute species based on a literature search conducted in accordance with 173-340-709(5)(f)(v)(C).

Additional species may be added on a site-specific basis as provided in 173-340-709(5)(f)(v)(A).

The department shall consider proposals for modifications to default values provided in this table based on new scientific information in accordance with 173-340-702(14).

- ^b Use the lowest of the three concentrations calculated as the wildlife screening value.

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Table 8
Default values for selected hazardous substances^a

Toxicity reference value (mg/kg – d)			Toxicity reference value (mg/kd - d)		
Substance	BAF _{Worm}	K _{Plant}	Shrew	Vole	Robin
INORGANIC SUBSTANCES:					
Antimony					
Arsenic III	1.16	0.06	1.89	1.15	
Arsenic V	1.16	0.06	35	35	22
Barium					
Beryllium					
Cadmium	4.6	0.14	15	15	20
Chromium III	0.49		5		
Chromium VI	0.49		35.2	29.6	5
Cobalt					
Copper	0.88	0.024	44	33.6	61.7
Lead	0.69	0.0047	20	20	11.3
Magnesium					
Manganese					
Mercury, inorganic	1.32	0.0854	2.86	2.18	0.9
Mercury, organic	1.32		0.352	0.27	0.064
Molybdenum					
Nickel	0.78	0.047	175.8	134.4	107
Silver					
Selenium	10.5	0.0065	0.725	0.55	1
Tin					
Vanadium					
Zinc	3.19	0.095	703.3	537.4	131
ORGANIC CHEMICALS:					
Acenaphthene					
Aldicarb/aldicarb sulfone					
Aldrin	4.77		2.198	1.68	0.06
Benzo(a)pyrene	0.43		11.9	9.09	
BHC (incl. lindane)	10.1		28.13	21.5	2.25
Bis (2-ethylhexyl) phthalate					
Carbofuran					
Chlordane	17.8		10.9	8.36	10.7
Chlorpyrifos/ chlorpyrifos-methyl					
D-n-butyl phthalate					
DDT/DDD/DDE	10.6		8.79	6.72	0.87
Dibenzofuran					
Dieldrin	28.8		0.44	0.34	4.37
Dioxins	48		2.2E-05	1.7E-05	1.4E-04
Endosulfan					
Endrin					
Heptachlor/heptachlor epoxide	10.9		2.857	2.18	0.48
Hexachlorobenzene					
Hexachlorophene					
Parathion/methyl parathion					
Proposed MTCA Rule Revisions					
02-12-98					

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PCBs	4.58	0.668	0.51	1.8
Pentachlorobenzene				
Pentachlorophenol	5.18	5.275	4.03	
Toxaphene				

^a Level 1 (screening level) evaluation. For hazardous substances not shown in this table, use the following default values. Alternatively, use values established from a literature survey conducted in accordance with 173-340-709(5)(f)(v)(C) and approved by the department.

K_{Plant} : Metals (including metalloid elements): 1.01

Organic chemicals: $10^{(1.588-(0.578 \cdot \log K_{ow}))}$

where $\log K_{ow}$ is the logarithm of the octanol-water partition coefficient

BAF_{Worm} : Metals (including metalloid elements): 4.6

Non-chlorinated organic chemicals:

$\log K_{ow} < 5$: 0.7

$\log K_{ow} \geq 5$: 0.9

Chlorinated organic chemicals:

$\log K_{ow} < 5$: 4.7

$\log K_{ow} \geq 5$: 11.9

$RGAF_{Soil}$ (all receptors): 1.0

Toxicity reference values (all receptors): Values established from a literature survey conducted in accordance with 173-340-709(5)(f)(v)(C).

Level 2 evaluation. Site-specific values may be substituted for default values, as described below:

K_{Plant} Value obtained from empirical studies at the site.

BAF_{Worm} Value obtained from empirical studies at the site.

$RGAF_{Soil}$ (all receptors): Value established from a literature survey conducted in accordance with 173-340-709(5)(f)(v)(C)

Toxicity reference values (all receptors): For chemicals not included in this table, values shall be established from a literature survey conducted in accordance with 173-340-709(5)(f)(v)(C) and approved by the department. Default toxicity reference values provided in this table may be replaced by a value established from a literature survey conducted in accordance with 173-340-709(5)(f)(v)(C) if it can be shown that the proposed value is more relevant to site-specific conditions (e.g., the value is based on a chemical form of the hazardous substance actually present at the site).

WAC 173-340-710 Applicable local, state and federal laws. (1) Applicable state and federal laws.

(a) All cleanup actions conducted under this chapter shall comply with applicable state and federal laws. For purposes of this chapter, the term "applicable state and federal laws" shall include legally applicable requirements and those requirements that the department determines, based on consideration of the criteria in subsection (3) of this section, are relevant and appropriate requirements.

(b) The person conducting a cleanup action shall identify all applicable state and federal laws. The department shall make the final interpretation on whether these

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requirements have been correctly identified and are legally applicable or relevant and appropriate.

(2) Legally applicable requirements. Legally applicable requirements include those cleanup standards, standards of control, and other environmental protection requirements, criteria, or limitations promulgated under state or federal law that specifically address a hazardous substance, cleanup action, location or other circumstances at the site.

(3) Relevant and appropriate requirements. Relevant and appropriate requirements include those cleanup standards, standards of control, and other environmental requirements, criteria, or limitations established under state or federal law that, while not legally applicable to the hazardous substance, cleanup action, location, or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. WAC 173-340-710 through 173-340-760 identifies several requirements the department shall consider relevant and appropriate for establishing cleanup standards. For other regulatory requirements, the following criteria shall be evaluated, where pertinent, to determine whether such requirements are relevant and appropriate for a particular hazardous substance, remedial action, or site:

(a) Whether the purpose for which the statute or regulations under which the requirement was created is similar to the purpose of the cleanup action;

(b) Whether the media regulated or affected by the requirement is similar to the media contaminated or affected at the site;

(c) Whether the hazardous substance regulated by the requirement is similar to the hazardous substance found at the site;

(d) Whether the entities or interests affected or protected by the requirement are similar to the entities or interests affected by the site;

(e) Whether the actions or activities regulated by the requirement are similar to the cleanup action contemplated at the site;

(f) Whether any variance, waiver, or exemption to the requirements are available for the circumstances of the site;

(g) Whether the type of place regulated is similar to the site;

(h) Whether the type and size of structure or site regulated is similar to the type and size of structure or site affected by the release or contemplated by the cleanup action; and

(i) Whether any consideration of use or potential use of affected resources in the requirement is similar to the use or potential use of the resources affected by the site or contemplated cleanup action.

(4) Variances. For purposes of this chapter, a regulatory variance or waiver provision included in an applicable state and federal law shall be considered potentially applicable to interim actions and cleanup actions and the department may determine that a particular regulatory variance or waiver is appropriate if the substantive conditions for such a regulatory variance or waiver are met. In all such cases, interim actions and cleanup actions shall be protective of human health and the environment.

(5) New requirements. The department shall consider new applicable state and federal laws as part of the periodic review under WAC 173-340-420. Cleanup actions shall be evaluated in light of these new requirements to determine whether the cleanup action is still protective of human health and the environment.

(6) Selection of cleanup actions. To demonstrate compliance with WAC 173-340-360, cleanup actions shall comply with all applicable state and federal laws in addition to

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the other requirements of this chapter. The following, which is not a complete list, are selected applications of specific applicable state and federal laws to cleanup actions.

(a) Water discharge requirements. Hazardous substances which are directly or indirectly released or proposed to be released to waters of the state shall be provided with all known, available and reasonable methods of treatment consistent with the requirements of chapters 90.48 and 90.54 RCW and the regulations that implement those statutes.

(b) Air emission requirements. Best available control technologies consistent with the requirements of chapter 70.94 RCW and the regulations that implement this statute shall be applied to releases of hazardous substances to the air resulting from cleanup actions at a site.

(c) Solid waste landfill closure requirements. For solid waste landfills, the solid waste closure requirements in chapter 173-304 WAC shall be minimum requirements for cleanup actions conducted under this chapter. In addition, when the department determines that the closure requirements in chapters 713-351 and 173-303 WAC are applicable or relevant and appropriate requirements, the more stringent closure requirements under ~~that law~~ those laws shall also apply to cleanup actions conducted under this chapter.

~~(d) Sediment management requirements. Sediment cleanup actions conducted under this chapter shall comply with the sediment cleanup standards in chapter 173-204 WAC. In addition, a state remedial investigation/feasibility study conducted under WAC 173-340-350 shall also comply with the cleanup study plan requirements under chapter 173-204 WAC. The process for selecting sediment cleanup actions under this chapter shall comply with the requirements in WAC 173-340-360. [See 173-340-760]~~

(7) Interim actions. Interim actions conducted under this chapter shall comply with legally applicable requirements. The department may also determine, based on the criteria in subsection (3) of this section, that other requirements, criteria, or limitations are relevant and appropriate for interim actions.

(8) Permit exemptions. (a) Pursuant to RCW 70.105D.090, remedial actions conducted under a consent decree, order, or agreed order, and the department when it conducts a remedial action are exempt from the procedural requirements of certain laws. This exemption shall not apply if the department determines that the exemption would result in loss of approval from a federal agency necessary for the state to administer any federal law. This exemption applies to the following laws:

(i) Chapter 70.94 RCW;

(ii) Chapter 70.95 RCW;

(iii) Chapter 70.105 RCW;

(iv) Chapter 75.20 RCW;

(v) Chapter 90.48 RCW;

(vi) Chapter 90.58 RCW; and,

(vii) Any laws requiring or authorizing local government permits or approvals for the remedial action.

(b) Remedial actions exempt from procedural requirements under provision (a) of this subsection shall comply with the substantive requirements of these laws. The department shall ensure compliance with the substantive requirements and provide an opportunity for comment by the public and by the state agencies and local governments that would otherwise implement these laws as follows:

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(i) Potentially liable persons and the department, prior to proposing any permit exemption, shall informally consult with the state agencies and local governments to identify potential permits and substantive requirements.

(ii) The permits proposed for exemption and the substantive requirements, to the extent they are known, shall be identified in the order, decree, or if the cleanup is being conducted by the department, in the work plan prepared by the department.

(iii) A public notice of the order, decree or work plan shall be issued in accordance with Chapter 173-340-600 WAC. The notice shall specifically identify the permits proposed for exemption and seek comment on these exemptions. This notice shall be mailed to the state agencies and local governments that would otherwise implement these permits. This notice shall also be mailed to the same individuals that the state agencies and local government would normally mail notice to if a permit was being issued.

(iv) Substantive requirements, to the extent known and identified by the state agencies and local governments prior to issuance of the order, decree or work plan and those identified by the state agencies and local government during the public comment period shall be incorporated into the order, decree or work plan. It shall be the continuing obligation of persons conducting remedial actions to determine whether additional permits or approvals or substantive requirements are required. In the event that either person conducting the remedial action or the department becomes aware of additional permits or approvals or substantive requirements that apply to the remedial action, they shall promptly notify the other party of this knowledge. The department, or the potentially liable person at the department's request, shall consult with the state or local agency on these additional requirements. The department, shall make the final determination on the application of any additional substantive requirements at the site.

(v) State and local agencies may charge a fee to the person conducting the remedial action to defray the costs of services rendered relating to identification of substantive requirements under this provision.

WAC 173-340-720 Ground water cleanup standards. (1) General considerations.

(a) Ground water cleanup levels shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. The department has determined that ~~for~~ at most sites use of ground water as a source of drinking water is the beneficial use requiring the highest quality of ground water and that exposure to hazardous substances via ingestion of drinking water and other domestic uses represents the reasonable maximum exposure. In the event of a release of a hazardous substance, ~~treatment, removal, or containment measures~~ a cleanup action complying with WAC 173-340-360 shall be conducted to ~~reduce~~ address all areas of the site where the concentration of the hazardous substance in ground water to a concentration consistent with this use unless the following can be demonstrated exceeds concentrations based on use of the ground water as a source of drinking water, unless otherwise provided for in this section.

(b) Drinking water sources. Ground water cleanup levels for ground water classified as a drinking water source shall be established using either method A or method B as described in subsections (2) and (3) of this section. Ground water shall be classified as a drinking water source unless the following can be demonstrated:

(i) The ground water does not serve as a current source of drinking water;

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(ii) The ground water is not a potential future source of drinking water for any of the following reasons:

(A) The ground water is present in insufficient quantity to yield greater than 0.5 gallon per minute on a sustainable basis ~~to a well in compliance with chapter 173-160 WAC and in accordance with normal domestic water well construction practices for the area in which the site is located;~~ as evidenced by the average yield achieved in a pump test conducted for a minimum of 24 hours on a test well constructed to be representative of a domestic water supply well; or

(B) The ground water contains natural background concentrations of organic or inorganic constituents ~~which that make use of the water for~~ as a drinking water source not practicable. Ground water containing total dissolved solids at concentrations greater than 10,000 mg/l shall normally be considered to have fulfilled this requirement (NOTE: The total dissolved solids concentration is provided here as an example of application of this provision. There may be other hazardous substances at high natural background levels that also meet this requirement.); ~~or and,~~

~~(C) The ground water is situated at a great depth or location which makes recovery of water for drinking water purposes technically impossible; and~~

(iii) The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in ~~(a)~~ (b) (i) and (ii) of this subsection, at concentrations which exceed ground water quality criteria published in chapter 173-200 WAC; ~~or~~ .

~~_____~~ (iv) More stringent concentrations are necessary to protect human health or the environment.

~~(b) In making a determination under (a) – (iii) of this subsection–~~ this provision, the department shall consider site-specific factors including:

(i) (A) The extent of affected ground water;

(ii) (B) The distance to existing water supply wells;

(iii) (C) The likelihood of interconnection between the contaminated ground water and ground water that is a current or potential future source of drinking water due to well construction practices in the area of the state where the site is located;

(iv) (D) The physical and chemical characteristics of the hazardous substance;

(v) (E) The hydrogeologic characteristics of the site;

(vi) (F) The presence of discontinuities in the affected geologic stratum; and

(vii) (G) The degree of confidence in any predictive modeling performed.

(c) Ground water near certain surface waters. The department recognizes that there may be sites near nonpotable surface water where there is an extremely low probability that ground water classified as a potential future source of drinking water under (b) of this subsection will actually be used for that purpose (~~i.e. for example, the shallow ground waters in close proximity to marine waters such as~~ on Harbor Island). At such sites, the department may approve ground water cleanup levels that are based on protecting beneficial uses of the nearby adjacent surface water under subsection (3)(c) of this section if the person undertaking the cleanup action can demonstrate all of the following:

(i) The extent of the contamination and the hydrogeology of the site and the area between the source(s) of the contamination and the surface water has been sufficiently

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defined so that there are known or projected points of entry of the ground water into the surface water;

(ii) The surface water is not classified as a suitable domestic water supply source under chapter 173-201A WAC and the ground water at the property is sufficiently hydraulically connected to the surface water that it is not practicable to use the ground water for a drinking water source for reasons other than that it has been contaminated by a release of a hazardous substance;

(iii) Ground water flows into surface waters will result in no exceedances of surface water or sediment cleanup levels at the point of entry or at any downstream location where it is reasonable to believe that hazardous substances may accumulate;

(iv) Current developments on the site and any areas potentially affected by the ground water contamination are served by a public water system that obtains its water from an offsite source and it can be demonstrated that the water system has sufficient capacity to serve future development in these areas;

(v) The use of a ground water cleanup level based on protection of surface waters would not otherwise pose a threat to human health or the environment (for example, causing unacceptable levels of vapors in buildings overlying contaminated ground water or impeding construction or maintenance activities);

(vi) The local government with land use planning jurisdiction and any water purveyors with water supply jurisdiction for the site and any other areas potentially affected by the ground water contamination have been mailed a notice of the proposal to base cleanup levels on protection of surface water beneficial uses rather than as a potential future source of drinking water. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments, including providing information on planned uses of the ground water. The department will give greater weight to information based on an adopted or pending plan or similar preexisting document;

(vii) The property owners within the site and within the area between the source of hazardous substances and any other areas potentially affected by the ground water contamination have been mailed a notice of the proposal to base cleanup levels on protection of surface water beneficial uses rather than as a potential future source of drinking water. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments, including providing information on planned uses of the ground water;

(viii) The cleanup action includes institutional controls complying with WAC 173-340-440 that will prevent the use of contaminated ground water for drinking water purposes and other ground water uses or site activities inconsistent with the selected cleanup level. at any point The institutional controls shall be required on the property within the site and on all properties between the source of hazardous substances and the point(s) of entry of the ground water into the surface water and on any other properties potentially affected by the ground water contamination; and,

(ix) The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in (b) of this subsection, at concentrations which exceed ground water quality criteria published in chapter 173-200 WAC. In making this determination the department shall consider site specific factors, including the criteria under (b)(iii) of this subsection.

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(d) Protection of nonpotable ground water. At sites where the ground water is not a current or potential future source of drinking water under the criteria in WAC 173-340-720(1)(b), the department may approve a ground water cleanup level based on a beneficial use other than drinking water under WAC 173-340-720(3)(d) if all of the following criteria are met:

(i) The extent of the contamination and hydrogeology of the site and the area in the vicinity of the site have been sufficiently defined so that the potential migration pathways and potential ultimate extent of the ground water contamination are known or have been reasonably projected;

(ii) Current developments on the site and any areas potentially affected by the ground water contamination are served by a public water system that obtains its water from an offsite source and it can demonstrated that the water system has sufficient capacity to serve future development in these areas;

(iii) The use of a ground water cleanup level based on other than a drinking water beneficial use would not otherwise pose a threat to human health or the environment (for example, causing unacceptable levels of vapors in buildings overlying contaminated ground water or impeding construction or maintenance activities);

(vi) The local government with land use planning jurisdiction and any water purveyors with water supply jurisdiction for the site and any other areas potentially affected by the ground water contamination have been mailed a notice of the proposal to base cleanup levels on other than a drinking water beneficial use. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments, including providing information on planned uses of the ground water. The department will give greater weight to information based on an adopted or pending plan or similar preexisting document;

(vii) The property owners within the site and within the area between the source of hazardous substances and any other areas potentially affected by the ground water contamination have been mailed a notice of the proposal to base cleanup levels on other than a drinking water beneficial use. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments, including providing information on planned uses of the ground water;

(viii) The cleanup action includes institutional controls complying with WAC 173-340-440 that will prevent the use of contaminated ground water for drinking water purposes and other ground water uses and site activities inconsistent with the selected cleanup level. The institutional controls shall be required on the property within the site and on any other properties potentially affected by the ground water contamination; and,

(ix) The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in (b) of this subsection, at concentrations which exceed ground water quality criteria published in chapter 173-200 WAC. In making this determination the department shall consider site specific factors, including the criteria under (b)(iii) of this subsection.

(e) Protection. The department may require more stringent cleanup levels than specified elsewhere in this section where necessary to protect beneficial uses other than drinking water or otherwise protect human health and the environment.

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~~—(d) Where more stringent cleanup levels are necessary to protect beneficial uses of ground water other than drinking water, the cleanup level shall be established by the department under methods B or C as appropriate.~~

~~(e)~~ (f) Cross-media contamination. Releases of hazardous substances to ground waters of the state shall not directly or indirectly cause violations of surface water, sediments, soil, or air cleanup standards established under this chapter or other applicable state and federal laws.

(2) Method A ground water cleanup levels. Method A ground water cleanup levels may be used at any site, subject to the limitations noted in WAC 173-340-704 and footnote a in table 720-1 of this section.

~~(a) Where the ground water is a current or potential future source of drinking water,~~
~~m~~ Method A ground water cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations listed in Table 4 720-1;

(ii) Concentrations established under applicable state and federal laws, including the following requirements:

(A) Maximum contaminant levels established under the Safe Drinking Water Act and published in 40 C.F.R. 141, ~~as amended~~;

(B) ~~M~~ Non-zero maximum contaminant level goals for noncarcinogens established under the Safe Drinking Water Act and published in 40 C.F.R. 141, ~~as amended~~;

(C) Secondary maximum contaminant levels established under the Safe Drinking Water Act and published in 40 C.F.R. 143, ~~as amended~~; and

(D) Maximum contaminant levels established by the state board of health and published in chapter ~~248-54 WAC, as amended~~ WAC 246-290-310; and,

(iii) For additional hazardous substances which are deemed indicator hazardous substances for ground water under WAC 173-340-708(2) and for which there is not a value in table 720-1 or in applicable state and federal laws, the cleanup level shall be established at the natural background concentration or the practical quantification limit, subject to the limitations in this chapter. [NOTE: Users should consider using method B, rather than method A, to establish cleanup levels at these sites.]

(b) The department may establish method A cleanup levels more stringent than those required by (a) of this subsection when, based upon site-specific evaluations, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 and 708.

~~(c) Cleanup levels to protect beneficial uses of ground water other than drinking water shall be established by the department under methods B or C, as appropriate.~~

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Table 1
Method A Cleanup Levels - Ground Water^a

Hazardous Substance	CAS Number	Cleanup Level
Arsenic	7440-38-2	5.0 ug/liter ^b
Benzene	71-43-2	5.0 ug/liter ^c
Cadmium	7440-43-9	5.0 ug/liter ^d
Chromium (Total)	7440-47-3	50.0 ug/liter ^e
Chromium (Hexavalent)	18540-29-9	100 ug/liter ^{e1}
DDT	50-29-3	80 ug/liter ^{e2}
1,2 Dichloroethane	107-06-2	0.1 ug/liter ^f
Ethylbenzene	100-41-4	0.3 ug/liter ^f
Ethylene dibromide (EDB)	106-93-4	0.1 ug/liter ^g
Gross Alpha Particle Activity		5.0 ug/liter ^g
Gross Beta Particle Activity		30.0 ug/liter ^h
Lead	7439-92-1	700 ug/liter ^h
Lindane	58-89-9	0.01 ug/liter ⁱ
Methylene chloride	75-09-2	15.0 pCi/liter ⁱ
Mercury	7439-97-6	4.0 mrem/yr ^k
Methyl tertiary-butyl ether (MTBE)	1634-04-4	50 pCi/liter ^k
PAHs (carcinogenic)		15 ug/liter ^l
PCB mixtures		20 ug/liter ^{o2}
Radium 226 and 228		0.1 ug/liter ^p
Radium 226		0.2 ug/liter ^p
Tetrachloroethylene	127-18-4	0.4 ug/liter ^q
Toluene	108-88-3	5.0 pCi/liter ^r
Total Petroleum Hydrocarbons		3.0 pCi/liter ^s
1,1,1 Trichloroethane	71-55-6	5.0 ug/liter ^t
Trichloroethylene	79-01-5	40.0 ug/liter ^u
Vinyl chloride	75-01-4	1000.0 ug/liter ^v
Xylenes	1330-20-7	200.0 ug/liter ^w
		5.0 ug/liter ^x
		0.2 ug/liter ^y
		20.0 ug/liter ^z
		10000ug/liter ^z

^a Caution on misusing ~~method A tables~~ this table. ~~Method A tables have been developed for specific purposes. They are~~ This table is intended to provide cleanup levels that are protective at most, but not all, sites. ~~conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For example, the values in this table may not provide protective cleanup levels at sites impacting surface water or sites where the additive effects may need to be considered such as sites with multiple exposure pathways or multiple contaminants with the same toxic effect.~~ For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter. A decision on whether cleanup of contamination is necessary should be made using the process described in WAC 173-340-360.

^b Arsenic. Cleanup level based on natural background concentrations for state of Washington.

^c Benzene. Cleanup level based on applicable state and federal (WAC 296-290-310 and 40 CFR 141.61).

^d Cadmium. Cleanup level based on applicable state and federal law ~~and concentration derived using procedures in subsection (3)(a)(ii)(A) of this section and a hazard quotient of 0~~ (WAC 296-290-310 and 40 CFR 141.62).

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- ^{e1} Chromium (Total). Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.62).
- ^{e2} Chromium (Hexavalent). Cleanup level based on concentration derived using the procedures in subsection (3)(a)(ii)(A) of this section.
- ^f DDT. Cleanup levels based on concentration derived using procedures in subsection (3)(a)(ii)(B) of this section.
- ^g 1,2 Dichloroethane. Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ^h Ethylbenzene. Cleanup level based on applicable state and federal law ~~and prevention of adverse aesthetic characteristics~~ (WAC 296-290-310 and 40 CFR 141.61).
- ⁱ Ethylene dibromide. Cleanup level based on concentration derived using procedures in subsection (3)(a)(ii)(B) of this section and modified based on analytical considerations (i.e. Method B value adjusted upward to PQL).
- ^j Gross Alpha Particle Activity, excluding uranium. Cleanup level based on applicable state and federal law (WAC 296-290-310).
- ^k Gross Beta Particle Activity, including gamma activity. Cleanup level based on applicable state federal law (WAC 296-290-310).
- ^l Lead. Cleanup level based on applicable state and federal law ~~and prevention of unacceptable blood lead levels~~ (WAC 296-290-310 and 40 CFR 141.80).
- ^m Lindane. Cleanup level based on ~~concentration derived using procedures in subsection (3)(a)(ii)(B) of this section~~ applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ⁿ Methylene chloride. Cleanup level based on ~~concentration derived using the procedures in subsection (3)(a)(ii)(B) of this section~~ section applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ^{o1} Mercury. Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.62).
- ^{o2} Methyl tertiary-butyl ether (MTBE). Cleanup level based on federal drinking water advisory level.
- ^p PAHs (carcinogenic). Cleanup level based on ~~concentration derived using procedures in subsection (3)(a)(ii)(B) of this section and modified based on analytical considerations~~ drinking water standard for benzo(a)pyrene (WAC 296-290-310 and 40 CFR 141.61). This cleanup level is a total value for all PAH compounds.
- ^q PCB mixtures. Cleanup level based on ~~concentration derived using procedures in subsection (3)(a)(ii)(B) of this section and modified based on analytical considerations~~ drinking water standard for PCBs (WAC 296-290-310 and 40 CFR 141.61) adjusted to 1 X 10⁻⁵ risk. This cleanup level is a total value for all PCB compounds.
- ^r Radium 226 and 228. Cleanup level based on applicable state and federal law (WAC 296-290-310).
- ^s Radium 226. Cleanup level based on applicable state and federal law (WAC 296-290-310).
- ^t Tetrachloroethylene. Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ^u Toluene. Cleanup level based on applicable state and federal law ~~and prevention of adverse aesthetic characteristics~~ (WAC 296-290-310 and 40 CFR 141.61).

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- ^v Total Petroleum Hydrocarbons. Cleanup level based on prevention of adverse aesthetic characteristics. This is a total value for all petroleum hydrocarbons in the ground water. Note that petroleum contaminated sites must also meet cleanup levels for individual petroleum components listed in this table and any other ARARs for contaminants at the site.
- ^w 1,1,1 Trichloroethane. Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ^x Trichloroethylene. Cleanup level based on applicable state and federal law (WAC 296-290-310 and 40 CFR 141.61).
- ^y Vinyl chloride. Cleanup level based on concentration derived using procedures in subsection (3)(a)(ii)(B) of this section and modified based on analytical considerations (method B adjusted upward to PQL).
- ^z Xylenes. Cleanup level based on applicable state and federal law ~~and prevention of adverse aesthetic characteristics;~~ (WAC 296-290-310 and 40 CFR 141.61)

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(3) Method B ground water cleanup levels. (a) Method B ground water cleanup levels may be used at any site. Where the ground water ~~is a current or potential future source of~~ cleanup level is based on a drinking water beneficial use, method B cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations established under applicable state and federal laws, including the requirements in subsection (2)(a)(ii) of this section;

(ii) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the following methods:

(A) Concentrations which are estimated to result in no acute or chronic toxic effects on human health as determined using the following equation and standard exposure assumptions:

$$\text{Ground water cleanup level} = \frac{\text{RFD} \times \text{ABW} \times \text{UCF} \times \text{HQ}}{(\text{ug/l}) \quad \text{DWIR} \times \text{INH} \times \text{DWF}}$$

Where:

RFD	=	Reference Dose as specified in WAC 173-340-708(7) (mg/kg-day)
ABW	=	Average body weight during period of exposure (16 kg)
UCF	=	Unit conversion factor (1,000 ug/mg)
HQ	=	Hazard quotient (1)
DWIR	=	Drinking water ingestion rate (1.0 liter/day)
INH	=	Inhalation correction factor as defined in WAC 173-340-720(7)
DWF	=	<u>Drinking water fraction (1.0);</u>

(B) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 1,000,000 as determined using the following equation and standard exposure assumptions:

$$\text{Ground water cleanup level} = \frac{\text{RISK} \times \text{ABW} \times \text{LIFE} \times \text{UCF}}{(\text{ug/l}) \quad \text{CPF} \times \text{DWIR} \times \text{DUR} \times \text{INH} \times \text{DWF}}$$

Where:

RISK	=	Acceptable cancer risk level (1 in 1,000,000)
ABW	=	Average body weight during the period of exposure (70 kg)
LIFE	=	Lifetime (75 years)
UCF	=	Unit conversion factor (1,000 ug/mg)
CPF	=	Carcinogenic potency factor as specified in WAC 173-340-708(8) (kg-day/mg)
DWIR	=	Drinking water ingestion rate (2.0 liters/day)
DUR	=	Duration of exposure (30 years)
INH	=	Inhalation correction factor as defined in WAC 173-340-720(7)
DWF	=	<u>Drinking water fraction (1.0); and,</u>

(iii) The solubility limit for the hazardous substance.

(iv) For petroleum hydrocarbons, a total petroleum hydrocarbon content of 1 part per million.

(b) The department may establish method B cleanup levels that are more stringent than those required by subsection (3)(a) of this section, when, based on a site-specific evaluations, the department determines such levels are necessary to protect human

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health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 and 708. This may include the following: Examples of situations that may trigger more stringent cleanup levels include the following:

- (i) Concentrations which are necessary to protect sensitive sub-groups;
- (ii) Concentrations which eliminate or minimize the potential for food chain contamination;
- (iii) Concentrations which eliminate or minimize the potential for damage to soils or biota in the soils which could impair the use of the soil for agricultural or silvicultural purposes;
- (iv) Concentrations which eliminate or minimize the potential for the accumulation of vapors in buildings or other structures to concentrations which pose a threat to human health or the environment; and
- (v) Concentrations which protect nearby surface waters. ~~In general, these will be based on attaining surface water cleanup levels in the surface water as close as technically possible to the point or points where the ground water flows into the surface water.~~

(c) Ground water cleanup levels based on surface water protection. Method B ground water cleanup levels based on protection of surface water under WAC 173-340-720(1)(c) shall use the surface water cleanup level derived under WAC 173-340-730 as the ground water cleanup level (See WAC 173-340-720(6)(d) for establishing a ground water point of compliance in these areas.).

(d) Nonpotable ground water cleanup levels. (i) Method B ground water cleanup levels based on nonpotable beneficial uses under WAC 173-340-720(1)(d) may be established using drinking water cleanup levels under methods A or B in this section, or using a surface water protection cleanup level under provision (3)(c) of this section. At sites where the department determines application of these approaches would be inappropriate, a site specific risk assessment may be used to establish ground water cleanup levels.

(ii) Where a site specific risk assessment is used to establish ground water cleanup levels under this provision, the risk assessment shall conform to the requirements in WAC 173-340-702 & 708. The risk assessment shall evaluate all potential exposure pathways and ground water uses at the site. Examples of exposure pathways and ground water uses that may need evaluation include the following:

- Irrigation, including potential consumption of irrigated food crops
- Industrial process water
- Heat pumps/non contact cooling water
- Stock watering
- Construction/maintenance dewatering
- Surface water impacts
- Vapors
- Ecological effects
- Short- term (accidental) ingestion of the ground water
- Recreational exposures
- Utility construction and maintenance activities
- Potential for ingestion of contaminated aquifer material

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- Soil excavation and disposal from construction/maintenance activities
- Dermal contact with the ground water and contaminated aquifer material.
- Cross contamination by drilling of wells through contaminated zones
- Effects on types of materials used for construction of utilities and other underground structures

- Effects on stormwater and sewer systems

(iii) Where a site specific risk assessment is used to establish a ground water cleanup level, the ground water cleanup level shall not exceed the solubility limit for individual hazardous substances and mixtures of hazardous substances;

(iv) The risk assessment shall demonstrate that the proposed cleanup levels will result in no significant acute or chronic toxic effects on human health and would not result in a hazard index exceeding one (1) for individual hazardous substances;

(v) The risk assessment shall demonstrate that the proposed cleanup levels will result in an upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}) for individual hazardous substances; and,

(vi) The risk assessment shall demonstrate that the proposed cleanup levels will not adversely impact public or private utilities.

(4) Method C ground water cleanup levels. This section does not provide for establishing method C ground water cleanup levels. Ground water cleanup levels may only be established using methods A or B.

~~— (a) Method C cleanup levels may be approved by the department if the person undertaking the cleanup action can demonstrate that such levels are consistent with applicable state and federal laws, that all practicable methods of treatment have been utilized, that institutional controls are implemented in accordance with WAC 173-340-440, and that one or more of the conditions in WAC 173-340-706(1) exist.~~

~~— (b) Where the ground water is a current or potential future source of drinking water as defined in subsection (1)(a) of this section, method C cleanup levels for ground water shall be at least as stringent as all of the following:~~

~~— (i) Concentrations established under applicable state and federal laws, including the requirements in subsection (2)(a)(ii) of this section;~~

~~— (ii) For hazardous substances for which sufficiently protective, health-based standards or criteria have not been established under applicable state and federal laws, those concentrations that protect human health as determined using the following methods:~~

~~— (A) Concentrations which are estimated to result in no significant acute or chronic toxic effects on human health and are estimated in accordance with WAC 173-340-720 (3)(a)(ii)(A) except that the average body weight shall be 70 kg and the drinking water intake rate shall be 2 liters/day;~~

~~— (B) Concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 100,000 and are estimated in accordance with WAC 173-340-720 (3)(a)(ii)(B);~~

~~— (c) The department may establish method C cleanup levels that are more stringent than those required by (b) of this subsection when, based on a site-specific evaluation, the department determines such levels are necessary to protect human health and the environment. This may include consideration of those factors listed in subsection (3)(b) of this section.~~

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~~(d) Method C cleanup levels that protect beneficial uses of ground water other than drinking water shall be established by the department on a case-by-case basis.~~

(5) Multiple hazardous substances/multiple pathways of exposure. Adjustments to Cleanup Levels.

(a) Total site risk adjustments. Ground water cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}).

(b) Adjustments to ARARs. ~~The overall limits on the hazard index and total excess cancer risk in (a) of this subsection shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including cleanup levels based on applicable state and federal laws. Where a cleanup level developed under subsection (2) or (3) of this section is based on an applicable state or federal law and the level of risk upon which the standard is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}) and the hazard index does not exceed one (1) at the site.~~

(c) Natural background and PQL considerations. Cleanup levels determined under subsections (2) and (3) of this section, including cleanup levels adjusted under provisions (5)(a) and (5)(b) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

(6) Point of compliance. (a) General. For ground water, the point of compliance is the point or points where the ground water cleanup levels established under subsections (2), (3), (4), and (5) of this section must be attained. Ground water cleanup levels shall be attained in all ground waters from the point of compliance to the outer boundary of the hazardous substance plume.

(b) Presumption. The point of compliance shall be established throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site.

(c) Conditional Point of Compliance. ~~Where hazardous substances remain on-site as part of the cleanup action, Where it can be demonstrated under WAC 173-340-360 that it is not practicable to meet the cleanup level throughout the site within a reasonable restoration timeframe,~~ the department may approve a conditional point of compliance which shall be as close as practicable to the source of hazardous substances, not to exceed the property boundary. Where a conditional point of compliance is proposed, the person responsible for undertaking the cleanup action shall demonstrate that all of the requirements in WAC 173-340-360(7) are met. ~~practicable methods of treatment are to be utilized in the site cleanup.~~

(d) Off-Property Conditional point of compliance. ~~At sites where the affected ground water flows into nearby surface water, the cleanup level may be based on protection of the surface water. At these sites, conditional points of compliance may be~~

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approved only if the following requirements are met: A conditional point of compliance shall not exceed the property boundary except in the following three situations described below. In each of these three situations the person responsible for undertaking the cleanup action shall demonstrate that all of the requirements in WAC 173-340-360(7) [update reference] are met:

(i) Sites Abutting Surface Water. Where the ground water cleanup level is based on protection of surface water under subsections (1)(c) or ~~(3)(d)~~ (1)(d) of this section, and the property containing the source of contamination directly abuts the surface water, the department may approve a conditional point of compliance that is located within the surface water as close as technically possible to the point or points where ground water flows into the surface water subject to the following conditions:

(A) It has been demonstrated that the contaminated ground water is currently entering the surface water or will enter the surface water even after all three requirements of WAC 173-3400360(7) have been met;

(B) It has been demonstrated under WAC 173-340-360 that it is not practicable to meet the cleanup level throughout the site or at point within the ground water prior to entry into the surface water, within a reasonable restoration timeframe.

(C) ~~(i)~~ Use of dilution within the surface water or a dilution mixing zone under WAC ~~173-201-035~~ 173-201A-100 to demonstrate compliance with surface water cleanup levels shall not be allowed;

(D) ~~(ii)~~ Ground water discharges shall be provided with all known available and reasonable methods of treatment prior to release into surface waters Source control measures and ground water treatment or containment measures have been implemented to the maximum extent practicable to minimize future releases to the surface water
[NOTE: The AKART issue is still being evaluated by the AG's Office];

(E) ~~(iii)~~ Ground water discharges shall not result in violations of sediment quality values published in chapter 173-204 WAC or adversely affect organisms in the benthic zone or shore areas of the surface water; and,

(F) ~~(iv)~~ Ground water monitoring shall be performed conducted to estimate contaminant flux rates and verify the long-term performance of source control and containment measures. Biomonitoring may also be required to address potential bioaccumulation problems resulting from surface water concentrations dilution of contaminants below method detection limits or to assess the toxicity of mixtures; and

(G) Prior to approval of the conditional point of compliance, the department shall notify the Washington State Department of Natural Resources and the United States Army Corps of Engineers of the proposal. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments on the proposal.

(ii) Sites Near Surface Water. Where the ground water cleanup level is based on protection of surface water under subsections (1)(c) or ~~(3)(d)~~ (1)(d) of this section and the property that is the source of the contamination is located near, but does not directly abut, a surface water body, the department may approve a conditional point of compliance that is located as close as practicable to the source, not to exceed a location within the surface water as close as technically possible to the point or points where ground water flows into the surface water. A conditional point of compliance may be approved under this provision only through a consent decree. For a conditional point of compliance to be approved under this provision the conditions in subsection (6)(d)(i) of this section and the following conditions must be met:

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(A) The owners of the property between the source of contamination and the surface water body agree, in writing, to the use of a conditional point of compliance; and

(B) Approval of the conditional point of compliance will not result in an expansion of the area of ground water contamination beyond the current overall extent. "Current" as used in this provision means as it existed at a time established by the department, no later than at the completion of the remedial investigation.

(iii) Areawide Conditional Point of Compliance. The department may approve an "areawide conditional point of compliance" to address an areawide groundwater contamination problem. This provision is not intended to relax the requirements for cleanup at areawide sites, it is merely intended to allow qualifying sites to be treated as final cleanup actions rather than interim actions. This provision may be applied only where the contamination is the result of multiple sources that have resulted in comingled plumes of contaminated ground water that are not practical to address separately, the contamination has impacted multiple properties owned by multiple parties, and the area affected by the ground water contamination is currently zoned for, and characterized by, industrial or commercial use. Each hazardous substance and source of the hazardous substance must be evaluated separately and the areawide conditional point of compliance must be set as close as practicable to the source(s) of contamination for each hazardous substance. A site may have more than one areawide conditional point of compliance to address multiple contaminants but no areawide conditional point of compliance may exceed the current overall extent of ground water contamination for the site. "Current" as used in this provision means extent of ground water contamination as it existed at a time established by the department, no later than at the completion of the remedial investigation. An areawide conditional point of compliance may be approved under this provision only through a consent decree and only if all of the following conditions have been met:

(A) The person conducting the cleanup action has demonstrated to the department under WAC 173-340-360 that it is not practicable to meet a point of compliance throughout the site and at each source's property boundary within the area within a reasonable restoration time frame;

(B) Sufficient information in the form of an areawide state remedial investigation and feasibility study has been developed to select a remedy for the areawide groundwater contamination;

(C) The areawide remedy complies with all requirements in WAC 173-340-360(7) and has been approved by the department;

(D) The potentially liable persons in the area develop a plan that has been approved by the department for the implementation of the areawide remedy;

(E) Access to properties within the area encompassed by the areawide conditional point of compliance can be obtained for conducting remedial actions necessary to implement the selected remedy;

(F) Current developments in the area encompassed by the areawide conditional point of compliance and any other areas potentially affected by the ground water contamination are served by a public water system that obtains its water from an offsite source and it can be demonstrated that the water system has sufficient capacity to serve future development in these areas;

(G) All properties within the area encompassed by the areawide conditional point of compliance will be subject to institutional controls that comply with WAC 173-340-440 and

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~~prohibit the use of the ground water for drinking water purposes and other uses and restrict activities inconsistent with the selected remedy. The cleanup action includes institutional controls on all properties within the area encompassed by the areawide conditional point of compliance and any other properties potentially affected by the release. The institutional controls shall comply with WAC 173-340-440 and shall restrict ground water uses and activities on affected properties inconsistent with the selected cleanup level;~~

~~(H) All property owners within the area have been mailed a notice of the proposed areawide remedy and areawide conditional point(s) of compliance and have concurred with the areawide remedy and areawide conditional point(s) of compliance. This notice shall be in addition to any notice provided under WAC 173-340-600;~~

~~(I) The local government with land use planning jurisdiction and any water purveyors with water supply jurisdiction for the site and any other areas potentially affected by the ground water contamination have been mailed a notice of the proposal to establish an areawide conditional point of compliance. The notice shall be in addition to any notice provided under WAC 173-340-600 and invite comments, including providing information on planned uses of the ground water. The department will give greater weight to information based on an adopted or pending plan or similar preexisting document; and,~~

~~(J) Other site-specific factors as determined by the department as necessary to minimize resource and land use impacts.~~

~~(e) Monitoring Wells & Surface Water Compliance. The department may require or approve the use of upland monitoring wells located between the surface water and the source of contamination to establish compliance where a conditional point of compliance has been established under subsections (6)(d)(i)&(ii) of this section. Where such monitoring wells are used, the department may consider an estimate of dilution between the monitoring well and the surface water benthic zone in evaluating whether compliance has been achieved. When evaluating whether it is appropriate to allow for dilution, the department shall consider site specific factors including whether the ground water could reach the surface water in ways that would not provide for dilution within the ground water flow system (such as dewatering during construction or maintenance activities or short circuiting through utility corridors or foundation drains).~~

~~(7) Inhalation correction factors.~~

~~(a) The inhalation correction factor is an adjustment factor which takes into account exposure to hazardous substances which are volatilized and inhaled during showering and other domestic activities. When available, hazardous substance-specific information shall be used to estimate these values.~~

~~(b) Where hazardous substance-specific information is not available, inhalation correction factors shall be one of the following:~~

~~(i) For volatile organic hazardous substances, 2; or~~

~~(ii) Other hazardous substances, 1.~~

~~(c) Where separate toxicity factors (reference doses and carcinogenic potency factors) are available for inhalation and oral exposures, the health hazards associated with the inhalation of hazardous substances in ground water during showering and other domestic activities may be evaluated separately from the health hazards associated with ingestion of drinking water. In these cases, the ground water cleanup level based on ingestion of drinking water shall be modified to take into account multiple exposure pathways in accordance with WAC 173-340-708(6).~~

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(8) Compliance monitoring.

(a) Compliance with ground water cleanup levels shall be determined by analyses of unfiltered ground water samples, unless it can be demonstrated that a filtered sample provides a more representative measure of ground water quality. Ecology expects that filtering will generally be acceptable for inorganic substances where:

(i) A properly constructed monitoring well cannot be sufficiently developed to provide low turbidity water samples;

(ii) Due to the natural background concentration of hazardous substances in the aquifer material, unfiltered samples would not provide a representative measure of ground water quality; and

(iii) Filtering is performed in the field with all practicable measures taken to avoid exposing the ground water sample to the ambient air prior to filtering.

(iv) Ecology expects that filtering will generally be allowed for hazardous substances such as iron and manganese.

(b) Sampling and analytical procedures shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. The sample design shall provide data which are representative of the site.

(c) The data analysis and evaluation procedures used to evaluate compliance with ground water cleanup levels shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. These procedures shall meet the following general requirements:

(i) Methods of data analysis shall be consistent with the sampling design;

(ii) When cleanup levels are based on requirements specified in applicable state and federal laws, the procedures for evaluating compliance that are specified in those requirements shall be utilized to evaluate compliance with cleanup levels unless those procedures conflict with the intent of this section;

(iii) Where procedures for evaluating compliance are not specified in an applicable state and federal law, statistical methods used shall be appropriate for the distribution of sampling data for each hazardous substance. ~~If the distribution of sampling data for a hazardous substance is inappropriate for statistical methods based on a normal distribution, then the data may be transformed.~~ Sampling data shall be assumed to be lognormally distributed unless it can be demonstrated another distribution is more appropriate. If the distributions for hazardous substances differ, more than one statistical method may be required;

(iv) Compliance with ground water cleanup levels shall be determined for each ground water monitoring well or other monitoring points such as a spring;

(v) The data analysis procedures identified in the compliance monitoring plan shall specify the statistical parameters to be used to determine compliance with ground water cleanup levels.

(A) For clean levels based on short-term or acute toxic effects on human health or the environment, an upper percentile concentration shall be used to evaluate compliance with ground water cleanup levels.

(B) For cleanup levels based on chronic or carcinogenic threats, the mean concentration shall be used to evaluate compliance with ground water cleanup levels unless there are large variations in concentrations relative to the mean concentration or a large percentage of concentrations below the detection limit;

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(vi) When active ground water restoration is performed, or containment technologies are used that incorporate active pumping of ground water, compliance with ground water cleanup levels shall be determined when the ground water characteristics at the site are no longer influenced by the cleanup action.

(d) Appropriate statistical methods include the following:

(i) A procedure in which a confidence interval for each hazardous substance is established from ground water sampling data and the ground water cleanup level is compared to the upper confidence interval; and

(ii) A parametric test for percentiles based on tolerance intervals to test the proportion of ground water samples having concentrations less than the ground water cleanup level; or

(iii) Other statistical methods approved by the department.

(e) If a confidence interval approach is used to evaluate compliance with a ground water cleanup level, the decision rule is a one-tailed test of the null hypothesis that the true ground water concentration exceeds the ground water cleanup level. Compliance with a ground water cleanup level shall be determined using the following criteria:

(i) The upper confidence limit on the true ground water concentration shall be less than the ground water cleanup level. Statistical tests shall be performed at a Type I error level of 0.05;

(ii) No single sample concentration shall be greater than two times the ground water cleanup level; and

(iii) Less than ten percent of the sample concentrations shall exceed the ground water cleanup level during a representative sampling period.

(f) If a method to test the proportion of ground water samples is used to evaluate compliance with a ground water cleanup level, compliance shall be determined using the following criteria:

(i) The true proportion of samples that exceed the ground water cleanup level shall be less than fifty percent. Statistical tests shall be performed with a Type I error level of 0.05; and

(ii) No single sample concentration shall be greater than two times the ground water cleanup level; and

(iii) Less than ten percent of the sample concentrations shall exceed the ground water cleanup level during a representative sampling period.

(g) For purposes of demonstrating compliance with ground water cleanup levels, measurements below the method detection limit shall be assigned a value equal to one-half the method detection limit. Measurement above the method detection limit but below the practical quantitation limit shall be assigned a value equal to the method detection limit. The department may approve alternate statistical procedures for handling nondetected values or values below the practical quantitation limit. Alternate procedures may include probit analysis and regression analysis.

WAC 173-340-730 Surface water cleanup standards. (1) General considerations.

(a) Surface water cleanup levels shall be based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. The classification and the highest beneficial use of a surface water body shall be determined in accordance with chapter

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173-201A WAC, as amended. Surface water cleanup levels for this presumed use shall be established in accordance with method A or method B cleanup levels described in subsection (2) and (3) of this section. In the event of a release of a hazardous substance, ~~treatment, removal, or containment measures~~ a cleanup action complying with WAC 173-340-360 shall be conducted to reduce the level of hazardous substances in surface water to concentrations consistent with uses specified under this section and chapter 173-201 WAC, as amended. ~~based on this use.~~

(b) Surface water cleanup levels established under this section apply to those surface waters of the state affected or potentially affected by releases of hazardous substances from sites addressed under this chapter. Ecology does not expect that cleanup standards will be applied to storm water runoff that is in the process of being conveyed to a treatment system.

(c) Releases of hazardous substances to surface waters of the state shall not directly or indirectly cause violations of groundwater, soil, sediment, or air cleanup standards established under this chapter or other applicable state and federal laws.

(2) Method A surface water cleanup levels. Method A surface water cleanup levels may be used at any site subject to the limitations in WAC 173-340-704.

(a) Method A surface water cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations established under applicable state and federal laws, including the following requirements:

(i) (A) All water quality criteria published in the water quality standards for surface waters of the state of Washington, chapter 173-201A WAC, as amended;

(B) Chapter 173-205, WAC;

(C) National toxics rule; and,

(ii) (D) Water quality criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health published pursuant to section 304 of the Clean Water Act. ; and,

(ii) For additional hazardous substances which are deemed indicator hazardous substances for surface water under WAC 173-340-708(2) and for which there is no value in applicable state and federal laws, cleanup levels shall be established at the natural background concentration or the practical quantification limit, subject to the limitations in this chapter. [NOTE: Users should consider using method B, rather than method A, to establish cleanup levels at these sites.]

(b) The department may establish method A surface water cleanup levels that are more stringent than those required under subsection (2)(a) of this section, when, based on site-specific evaluations, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.

(3) Method B surface water cleanup levels.

(a) Method B cleanup levels for surface waters shall be at least as stringent as all of the following:

(i) Concentrations established under applicable state and federal laws, including the following requirements:

(A) All water quality criteria published in the water quality standards for surface waters of the state of Washington, chapter 173-201A WAC, as amended;

(B) WAC 173-205;

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(C) National toxics rule; and,

~~(B)~~ (D) Water quality criteria based on the protection of aquatic organisms (acute and chronic criteria) and human health published pursuant to section 304 of the Clean Water Act unless it can be demonstrated that such criteria are not relevant and appropriate for a specific surface water body or hazardous substance.

(ii) Concentrations which are estimated to result in no significant adverse effects on the protection and propagation of wildlife, fish, and other aquatic life. For petroleum mixtures, concentrations that result in no narcotic toxicity using methods approved by the department may be used to establish concentrations for the protection of aquatic life;

(iii) The solubility limit for the hazardous substance; and,

~~(iii)~~ (iv) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the following methods:

(A) For surface waters which support or have the potential to support fish or shellfish populations, concentrations which are anticipated to result in no acute or chronic toxic effects on human health as determined using the following equations and standard exposure assumptions:

$$\text{Surface water cleanup level} = \frac{\text{RFD} \times \text{ABW} \times \text{UCF1} \times \text{UCF2} \times \text{HQ}}{(\text{ug/l}) \quad \text{BCF} \times \text{FCR} \times \text{FDF}}$$

Where:

RFD	=	Reference Dose as specified in WAC 173-340-708(7) (mg/kg-day)
ABW	=	Average body weight during the exposure period (70 kg)
UCF1	=	Unit conversion factor (1,000 ug/mg)
UCF2	=	Unit conversion factor (1,000 grams/liter)
BCF	=	Fish bioconcentration factor as defined in WAC 173-340-708(9) (unitless)
FCR	=	Fish consumption rate (54 grams/day)
FDF	=	Diet fraction (0.5)
HQ	=	Hazard Index (<u>1.0</u>)

(B) For surface waters which support fish or shellfish populations, concentrations which are anticipated to result in an excess cancer risk less than or equal to 4 in 1,000,000 one in one million (1×10^{-6}) as determined using the following equation and standard exposure assumptions:

$$\text{Surface water cleanup level} = \frac{\text{RISK} \times \text{ABW} \times \text{LIFE} \times \text{UCF1} \times \text{UCF2}}{(\text{ug/l}) \quad \text{CPF} \times \text{BCF} \times \text{FCR} \times \text{FDF} \times \text{DUR}}$$

Where:

CPF	=	Carcinogenic Potency Factor as specified in WAC 173-340-708(8) (kg-day/mg)
RISK	=	Acceptable cancer risk level (1 in 1,000,000)
ABW	=	Average body weight during the exposure period (70 kg)
LIFE	=	Lifetime (75 years)
UCF1	=	Unit conversion factor (1,000 ug/mg)
UCF2	=	Unit conversion factor (1,000 grams/liter)
BCF	=	Fish bioconcentration factor as defined in WAC 173-340-708(9) (unitless)
FCR	=	Fish consumption rate (54 grams/day)
FDF	=	Diet fraction (0.5)
DUR	=	Duration of exposure (30 years);

[NOTE: Previous drafts highlighted the fish consumption rate and diet fraction factors as being changed based on studies currently underway. It is now anticipated these studies will not be completed in time for this rule revision and so no changes are proposed to these factors at this time.]

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(C) For surface waters which represent a source or potential future source of drinking water, concentrations which are anticipated to result in no adverse impacts on human health as established in accordance with WAC 173-340-720(3)(a).

(b) The department may establish method B cleanup levels more stringent than those required by subsection (3)(a) of this section, when, based on site-specific evaluations, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.

(4) Method C surface water cleanup levels. This section does not provide procedures for establishing method C surface water cleanup levels. Methods A and B are the only methods available for establishing surface water cleanup levels at sites.

~~_____ (a) Method C cleanup levels may be approved by the department if the person undertaking the cleanup action can demonstrate that such levels are consistent with applicable state and federal laws, that all practicable methods of treatment have been utilized, that institutional controls are implemented in accordance with WAC 173-340-440, and that one or more of the conditions in WAC 173-340-706(1) exist.~~

~~_____ (b) Method C cleanup levels for surface waters shall be at least as stringent as all of the following:~~

~~_____ (i) Concentrations established under applicable state and federal laws, including the requirements identified in subsection (3)(a)(i) of this section;~~

~~_____ (ii) Concentrations which are estimated to result in no significant adverse effects on the protection and propagation of wildlife, fish and other aquatic life;~~

~~_____ (iii) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:~~

~~_____ (A) For surface waters which support or have the potential to support fish or shellfish populations, concentrations which are estimated to result in no significant acute or chronic toxic effects on human health or the environment and are estimated in accordance with WAC 173-340-730 (3)(a)(iii)(A) except that the fish diet fraction shall be twenty percent;~~

~~_____ (B) For surface waters which support or have the potential to support fish or shellfish populations, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 100,000 and are estimated in accordance with WAC 173-340-730 (3)(a)(iii)(B) except that the fish diet fraction shall be twenty percent;~~

~~_____ (C) For surface waters which represent a source or potential future source of drinking water, concentrations which are estimated to result in no adverse impacts on human health and are established in accordance with WAC 173-340-720(4); and~~

~~_____ (c) The department may establish method C cleanup levels that are more stringent than those required by (b) of this subsection when, based on site-specific evaluations, the department determines that such levels are necessary to protect human health and the environment.~~

(5) Multiple hazardous substances/multiple pathways of exposure. Adjustments for total site risk.

(a) Surface water cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account

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exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures specified in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}).

~~(b) These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including cleanup levels based on applicable state and federal laws. Where a cleanup level developed under subsection (2) or (3) of this section is based on an applicable state or federal law and the level of risk upon which the standard is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}) and the hazard index does not exceed one (1) at the site.~~

(6) Point of compliance.

(a) The point of compliance shall be the point or points at which hazardous substances are released to surface waters of the state unless the department has authorized a dilution mixing zone in accordance with WAC ~~173-201-035~~ 173-201A-100.

(b) Where hazardous substances are released to the surface water as a result of ground water flows, no dilution mixing zone shall be allowed to demonstrate compliance with surface water cleanup levels. See WAC 173-340-720 (6)(d) for additional requirements.

(7) Compliance monitoring.

(a) Sampling and analytical procedures shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. The sample design shall provide data which are representative of the site.

(b) The data analysis and evaluation procedures used to evaluate compliance with surface water cleanup levels shall be defined in a compliance monitoring plan prepared under WAC 173-340-410.

(c) Compliance with surface water cleanup standards shall be determined by analyses of unfiltered surface water samples, unless it can be demonstrated that a filtered sample provides a more representative measure of surface water quality.

(d) When surface water cleanup levels are based on requirements specified in applicable state and federal laws, the procedures for evaluating compliance that are specified in those requirements shall be utilized to evaluate compliance with surface water cleanup levels unless these procedures conflict with the intent of this section.

(e) Where procedures for evaluating compliance are not specified in an applicable state and federal law, the statistical methods used to evaluate compliance with surface water cleanup levels shall be appropriate for the distribution of the hazardous substance sampling data. Sampling data shall be assumed to be lognormally distributed unless it can be demonstrated that another distribution is more appropriate. If the distributions of individual hazardous substances differ, more than one statistical method may be required.

(f) For purposes of demonstrating compliance, measurements below the method detection limit shall be assigned a value equal to one-half of the method detection limit. Measurements above the method detection limit but below the practical quantitation limit shall generally be assigned a value equal to the method detection limit. The department may approve alternate statistical procedures for handling nondetected values or values

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below the practical quantitation limit. Alternate statistical procedures may include probit analysis and regression analysis.

(g) Sampling and analysis of fish tissue, ~~or shellfish, or other aquatic organisms~~ may be required to supplement water column sampling during compliance monitoring.

WAC 173-340-740 Unrestricted land use soil cleanup standards. (1) General considerations.

(a) Presumed exposure scenario. ~~s~~ Soil cleanup levels shall be based on estimates of the reasonable maximum exposure expected to occur under both current and future site use conditions. The department has determined that residential land use is generally the site use requiring the most protective cleanup levels and that exposure to hazardous substances under residential land use conditions represents the reasonable maximum exposure scenario for most land uses. Soil cleanup levels for this presumed exposure scenario shall be established in accordance with method A or method B cleanup levels described in subsections (2) and (3) of this section. In the event of a release of a hazardous substance, ~~treatment, removal, and/or containment measures~~ a cleanup action complying with WAC 173-340-360 shall be implemented conducted to address those soils with hazardous substance concentrations which exceed soil cleanup levels based on this use unless the property qualifies for industrial soil cleanup levels under WAC 173-340-745 or the department determines that ~~the following can be demonstrated:~~

~~—— (i) The property does not serve as a current residential area;~~
~~—— (ii) The property does not have the potential to serve as a future residential area based on the consideration of zoning, statutory and regulatory restrictions, comprehensive plans, historical use, adjacent land uses, and other relevant factors; and~~
~~—— (iii) Appropriate use restrictions are implemented at the property; or~~
~~—— (iv) M~~ ore stringent concentrations are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.

(b) How land use is considered in setting soil cleanup levels. There are two types of soil cleanup levels that may be established under this chapter--unrestricted and industrial. The methods for determining unrestricted land use soil cleanup levels are based on a residential land use exposure assumptions as described in this section. The methods for determining industrial property soil cleanup levels are described in WAC 173-340-745. In general, a site cleaned up to soil cleanup levels established under a residential land use exposure scenario shall be considered to be protective without any restrictions on the use of the property. (Note: Restrictions may still be required on these sites to prevent exposure to other contaminated media such as ground water beneath the property). A plan for site cleanup that does not achieve unrestricted land use soil cleanup levels may still be acceptable under this chapter. For this to happen, a applicant must demonstrate under the remedy selection process in WAC 173-340-360 that, among other things, it is not practicable to cleanup up the property by treating or removing contaminated soils to unrestricted use levels and, that leaving residual levels of contamination will be protective of human health and the environment. Since certain land uses should result in less exposure to residual soil contamination, the expected long term land use of the property can be considered when evaluating the protectiveness of a

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remedy under WAC 173-340-360. See WAC 173-340-360 for additional information on how to consider land use in the remedy selection process.

~~—— (c) Commercial property soil cleanup levels. For industrial land uses not qualifying under WAC 173-340-745 and commercial land uses, the presumption is that soil cleanup levels shall be established in accordance with residential areas unless it can be clearly demonstrated that this is inappropriate.~~

~~—— (i) For a property to qualify under this subsection, it must be clearly demonstrated that:~~

~~—— (A) The property is currently zoned for or otherwise officially designated for industrial/commercial use;~~

~~—— (B) The property is currently used for industrial/commercial purposes or has a history of use for industrial/commercial purposes;~~

~~—— (C) Properties adjacent to and in the general vicinity of the property are used or are designated for use for industrial/commercial purposes; and~~

~~—— (D) The property and properties adjacent to and in the general vicinity are expected to be used for industrial/commercial purposes for the foreseeable future due to site zoning, statutory or regulatory restrictions, comprehensive plans, adjacent land use, and other relevant factors.~~

~~—— (ii) For industrial/commercial land uses qualifying under this subsection, soil cleanup levels shall be established as close as practicable to the method B soil cleanup levels established under subsection (3) of this section and shall be at least as stringent as the method C soil cleanup levels established under subsection (4) of this section. The overall limits on hazard index and total excess cancer risk specified in subsections (3) through (5) of this section shall apply to these sites.~~

~~—— (iii) Institutional controls under WAC 173-340-440 shall be required for industrial/commercial land uses qualifying under this subsection where soil cleanup levels are less stringent than method B soil cleanup levels established under subsection (3) of this section.~~

~~—— (iv) Soil cleanup levels for areas beyond the commercial/industrial property boundary that do not qualify for commercial soil cleanup levels under this subsection (including implementation of institutional controls and a covenant restricting use of the property to commercial or industrial use, as applicable) shall use method A or method B cleanup levels as described in subsections (2) or (3) of this section.~~

~~—— (v) The department expects that only industrial/commercial properties located in the interior portion of a large industrial/commercial area will qualify for other than method A or method B cleanup levels under this subsection.~~

~~(d) Other nonresidential properties soil cleanup levels.~~

~~(i) Soil cleanup levels for childcare facilities and schools shall be established in accordance with method A or method B cleanup levels as described in subsections (2) and (3) of this section.~~

~~—— (ii) For other nonresidential land uses such as recreational or agricultural uses, soil cleanup levels shall be established on a case-by-case basis.~~

~~—— (A) The overall limits on the hazard index and cancer risk specified in subsections (3) through (5) of this section shall apply to these types of sites.~~

~~—— (B) Soil cleanup levels for these types of sites shall be at least as stringent as method C cleanup levels established under subsection (4) of this section.~~

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~~—(C) Where other than a method A (residential) or method B soil cleanup level is proposed at these properties, the cleanup action shall include appropriate institutional controls implemented in accordance with WAC 173-340-440 to limit potential exposure to residual contamination. This shall include, at a minimum, placement of a covenant on the property restricting use of the property to the land use(s) the cleanup level is based on.~~

~~(e) (h) Relationship between soil cleanup levels and other cleanup standards. Soil cleanup levels shall be established at concentrations which that do not directly or indirectly cause violations of ground water, surface water, sediment, or air cleanup standards established under this chapter or applicable state and federal laws. A property that qualifies for other than a method A or method B a method C industrial soil cleanup level under this subsection WAC 173-340-745 does not necessarily qualify for other than a method A or method B a method C cleanup level in other media. Each medium must be evaluated separately using the criteria applicable to that medium.~~

~~(2) Method A soil cleanup levels. (2) Method A soil cleanup levels. Method A soil cleanup levels may be used at any site that is not an ecologically sensitive (tier III) site under WAC 173-340-709 and with a limited number of hazardous substances with the same toxic effect (so that additive effects need not be considered) , subject to the limitations noted in WAC 173-340-704 and footnote a of table 740-1.~~

~~(a) Method A cleanup levels shall be at least as stringent as all of the following:~~

~~(i) Concentrations in the following table 740-1; and~~

~~(ii) Concentrations established under applicable state and federal laws;~~

~~(b) For sites with additional hazardous substances which are deemed indicator hazardous substances under WAC 173-340-708(2) for which there is no value in Table 2 or applicable state and federal laws, cleanup levels for these additional hazardous substances shall be established at the natural background concentration or the practical quantification limit, subject to the limitations in this chapter. [NOTE: Users should consider using method B, rather than method A, to establish cleanup levels at these sites.]~~

~~(c) The department may establish method A cleanup levels that are more stringent than those required by subsection (2)(a) of this section, when based on a site-specific evaluation, the department determines that such levels are necessary to protect human health or environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.~~

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Table 2 740-1
Method A Soil Cleanup Levels ~~for~~ for Unrestricted Land Uses ^{a1}

Hazardous Substance	CAS Number	Cleanup Level	Tier II Eco Sites ^{a2}
Arsenic	7440-38-2	20.0 mg/kg ^b **	
Benzene	71-43-2	0.5 mg/kg^e 0.02 mg/kg ^c	
Cadmium	7440-43-9	2.0 mg/kg^d 8.0 mg/kg ^d	
Chromium (total)	7440-47-3	100.0 mg/kg ^{e1}	
Chromium (hexavalent)	18540-29-9		31 mg/kg ^{e2}
Copper	7440-50-8		600 mg/kg ^{e3}
DDT	50-29-3	1.0 mg/kg^f 2.0 mg/kg ^{f1}	140 mg/kg 1 mg/kg
1,2 Dichloroethane	107-06-2		0.005 mg/kg ^{f2}
1,1 Dichloroethylene	75-35-4		0.06 mg/kg ^{f3}
Ethylbenzene	100-41-4	20.0 mg/kg^g 5.0 mg/kg ^g	
Ethylene dibromide (EDB)	106-93-4	0.001 mg/kg^h 0.002 mg/kg ^h	
Lead	7439-92-1	250.0 mg/kg ^{i**}	220 mg/kg
Lindane	58-89-9	1.0 mg/kg^j 0.002 mg/kg ^j	
Methylene chloride	75-09-2	0.5 mg/kg^k 0.02 mg/kg ^k	
Mercury (inorganic)	7439-97-6	1.0 mg/kg^l 2.0 mg/kg ^{l1}	
MTBE	1634-04-4		0.1 mg/kg ^{l2}
PAHs (carcinogenic)		1.0 mg/kg^m 0.7 mg/kg ^m	
PCB Mixtures		1.0 mg/kgⁿ 0.5 mg/kg ⁿ¹	
Pentachlorophenol	87-86-5		3.0 mg/kg ⁿ²
Tetrachloroethylene	127-18-4	0.5 mg/kg^o 0.05 mg/kg ^o	
Toluene	108-88-3	40.0 mg/kg^p 0.2 mg/kg ^p	
TPH (gasoline)		100.0 mg/kg ^{q**}	
TPH (diesel)		200.0 mg/kg ^{r1}	
TPH (mineral oil)			2000 mg/kg ^{r2**}
TPH (other) (heavy fuel & lubricating oils, other)		200.0 mg/kg ^s **	
1,1,1 Trichloroethane	71-55-6	20.0 mg/kg^t 2.0 mg/kg ^{t1}	
1,1,2 Trichloroethane	79-00-5		0.005 mg/kg ^{t2}
Trichloroethylene	79-01-5	0.5 mg/kg^u 0.03 mg/kg ^{u1}	
Vinyl Chloride	75-01-4		0.002 mg/kg ^{u2}
Xylenes	1330-20-7	20.0 mg/kg^v 80 mg/kg ^v	
Zinc	7440-66-6		6000 mg/kg ^w 270 mg/kg

** Value under further evaluation.

^{a1} Caution on misusing ~~method A tables~~ this table. ~~Method A tables have~~ This table ~~been developed for specific purposes. They are~~ is intended to provide cleanup levels that are protective at most, but not all, sites. ~~conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For example, the values in~~

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this table may not provide protective cleanup levels at ecologically sensitive tier III sites, at sites impacting surface water or sites where the additive effects of multiple contaminants need to be considered. For these reasons, the values in these tables should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter. A decision on whether cleanup of contamination is necessary should be made using the process described in WAC 173-340-360.

^{a2} The value in this column is to be used at sites classified as ecological tier II sites (see WAC 173-340-709).

^b Arsenic. Cleanup level based on background concentrations in the state of Washington. **[NOTE: Current data indicates natural background for arsenic is 7 ppm (upper 90% statewide). Also, modeling indicates this value may not be protective of groundwater.]**

^c Benzene. Cleanup level based on protection of ground water.

^d Cadmium. Cleanup level based on ~~plant~~ protection of ground water.

^{e1} Chromium (total). Cleanup level based on health risks associated with inhalation of resuspended dust.

^{e2} Chromium (hexavalent). Cleanup level based on protection of ground water.

^{e3} Copper. Cleanup level based on protection of ground water. This value may not be protective if the impacted ground water discharges to nearby surface water since aquatic organisms tend to be more sensitive than humans to copper.

^{f1} DDT. Cleanup level based on health risk associated with ingestion of soil concentrations ~~derived~~ using the procedures in subsection (3)(a)(iii)(B) of this section.

^{f2} 1,2 Dichloroethane. Cleanup level based on protection of ground water adjusted for practical quantitation limit.

^{f3} 1,1 Dichloroethylene. Cleanup level based on protection of ground water.

^g Ethylbenzene. Cleanup level based on protection of ground water.

^h Ethylene dibromide (EDB). Cleanup level based on protection of ground water adjusted for practical quantitation limit.

ⁱ Lead. Cleanup level based on preventing unacceptable blood lead levels due to ingestion of soil. [If IEUBK model is accepted for use, value would increase to 370 ppm, using model defaults.]

^j Lindane. Cleanup level based on ~~concentration derived using the procedures in subsection (3)(a)(iii)(B) of this section~~ protection of ground water.

^k Methylene chloride. Cleanup level based on protection of ground water.

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- ¹ Mercury. Cleanup level based on protection of ground water.
- ^m PAHs (carcinogenic). Cleanup level based on ~~concentration derived using the procedures in subsection (3)(a)(iii)(B) of this section~~ benzo(a)pyrene and protection of ground water adjusted for the practical quantitation limit.
- ⁿ¹ PCB Mixtures. Cleanup level based on health risk associated with ingestion of soil ~~concentration derived using the procedures in subsection (3)(a)(iii)(B) of this section.~~
- ⁿ² Penta Thlorophenol. Cleanup level based on protection of ground water adjusted for the practical quantitation limit. This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm pentachlorophenol contamination at this level does not have the potential to contaminate ground water.
- ^o Tetrachloroethylene. Cleanup level based on protection of ground water.
- ^p Toluene. Cleanup level based on protection of ground water.
- ^q Total Petroleum Hydrocarbons (gasoline). Cleanup level based on protection of ground water. **[NOTE: Preliminary modeling indicates this value may not be protective of ground water.]**
- ^{r1} Total Petroleum Hydrocarbons (diesel). Cleanup level based on protection of ground water.
- ^{r2} Total Petroleum Hydrocarbons (mineral oil). Cleanup level based on protection of ground water. **[This value is a reflection of current Ecology policy. Puget Sound Energy has recommended a value of 4000 ppm.]**
- ^s Total Petroleum Hydrocarbons (other). Cleanup level based on protection of ground water. [NOTE: Depending on how this product is defined, residual saturation considerations suggest this value could be increased to 1000 ppm and still be protective of ground water]
- ^{t1} 1,1,1 Trichloroethane. Cleanup level based on protection of ground water.
- ^{t2} 1,1,2 Trichloroethane. Cleanup level based on protection of ground water adjusted for practical quantitation limit.
- ^{u1} Trichloroethylene. Cleanup level based on protection of ground water.
- ^{u2} Vinyl Chloride. Cleanup level based on protection of ground water adjusted for practical quantitation limit.
- ^v Xylenes. Cleanup level based on protection of ground water.
- ^w Zinc. Cleanup level based on protection of ground water.

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(3) Method B cleanup levels for unrestricted land uses. (a) Method B cleanup levels for soils at sites with no restrictions on land use shall be at least as stringent as all of the following:

(i) (a) ARARs. Concentrations established under applicable state and federal laws;
(ii) (b) Ground water protection. Concentrations which will not cause contamination of ground water at levels which exceed method B ground water cleanup levels established under WAC 173-340-720. ~~as determined using the following criteria:~~

~~(A) For individual hazardous substances or mixtures, concentrations that are equal to or less than one hundred times the ground water cleanup level established in accordance with WAC 173-340-720 unless it can be demonstrated that a higher soil concentration is protective of ground water at the site;~~

~~(B) For total petroleum hydrocarbons, the person undertaking the cleanup may elect to make this demonstration on the basis of data on individual hazardous substances that comprise the total petroleum hydrocarbons.~~

(C) Conceptual overview. Three approaches may be used to derive unrestricted land use soil cleanup levels for ground water protection: a three-phase partitioning solution using fixed or variable parameters, a four-phase partitioning solution or site-specific residual saturation measurement for petroleum hydrocarbons, and leach tests.

(i) Deriving unrestricted soil cleanup levels using a three-phase partitioning solution using fixed parameter values.

Equation 1 may be used:

$$\text{Equation 1: } C_{\text{Soil}} = C_w [(K_d) + (\theta_w + \theta_a H' / \rho)] * DF$$

C Soil = Soil cleanup level (mg/kg)

Cw = Ground water cleanup level (mg/l)

Kd = Distribution coefficient (L/kg, organic Kd, Equation 2 metals Kd,

(ii) Deriving unrestricted land use soil cleanup levels using a three-phase partitioning solution and site-specific measurements or calculations.

(A) Site-specific measurements may include but shall not be limited to the soil fraction of organic carbon, hazardous substance distribution coefficient (Kd), mineral solubility and measurements of soil biodegradation rates.

Table 1

θ_w = Soil volumetric water content (0.321 cm³/cm³)

H' = Henry's Law constant (cm³/cm³)

θ_a = Soil volumetric air content (0.1 cm³/cm³)

ρ = Soil bulk density (1.85 g/cm³)

DF = Dilution factor (20)

(l) Organic chemical distribution coefficient. The distribution coefficient (Kd) for organic chemicals may be derived using:

Equation 2: $K_d = K_{oc} \times f_{oc}$

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Where:

Koc = Soil organic carbon partitioning coefficient (ml/g). The Koc values listed in Table 6 may be used to calculate default Kd values.

foc = Soil fraction of organic carbon (0.1%).

Table 1 inorganic (metals) distribution coefficients.

(iii) Deriving unrestricted land use soil cleanup levels using a three-phase partitioning solution and site-specific measurements or calculations.

(A) Site-specific measurements may include but shall not be limited to the soil fraction of organic carbon, hazardous substance distribution coefficient (Kd), mineral solubility and measurements of soil biodegradation rates.

Table 1: Inorganic Distribution Coefficients.

Compound	Kd (L/kg)
As	29
Cd	6.7
Total Cr	1,000
Cr (+6)	19
Cu	22
Hg	52
Ni	65
Pb	10,000
Se	5
Zn	62

(B) Site-specific calculations may include the use of computer models and calculation of a site-specific dilution factor (DAF).

(l) Deriving a site-specific distribution coefficient (Kd) value. A site-specific measurement of the distribution coefficient (Kd) may be made and used in

Equation 1 to calculate a unrestricted land use soil cleanup level that is protective of ground water. Three methods may be used to measure a site-specific Kd:

(1) Measuring the soil fraction of organic carbon (foc) content and deriving Kd. A site-specific measurement of the soil fraction of organic carbon below the root zone (e.g. soil greater than one meter in depth) may be made and used in Equation 2 to calculate a site-specific Kd. Soil fraction of organic carbon (foc) measurements shall be made in uncontaminated soil that is representative of site conditions. For inorganic substances, the Kd values given in (3) Deriving unrestricted land use soil cleanup levels using a three-pharse partitioning solution and site-specific measurements or calculations.

(2) Site-specific measurements may include but shall not be limited to the soil fraction of organic carbon, hazardous substances distribution coefficient (Kd), mineral solubility and measurements of soil bodegradation rates.

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(3) Using site-specific data to derive Kd. Organic and inorganic (metals) Kd may be derived by measuring hazardous substance concentrations in the soil and ground water at the same location. Measurements of the hazardous substance concentrations in the soil pore water may also be made. Equation 3 may be used to calculate a site-specific Kd:

Equation 3: $K_d = C_s / C_w$

Where:

C_s = Soil chemical concentration (mg/kg)

C_w = Ground water or soil pore water chemical concentration (mg/l)

(4) Using batch equilibrium adsorption or desorption tests to derive Kd. Batch equilibrium testing involves mixing varying amounts of soil, water and contaminants under laboratory conditions to determine the ability of the soil to release or adsorb or release hazardous substances. A site-specific measurement of Kd may be made by use of batch equilibrium adsorption or desorption tests. Equation 4 may be used to derive a Kd from batch tests:

Equation 4: $\frac{x}{m} = K_d(C)^{1/n}$

Where:

x = amount or mass of solute adsorbed (mg)

m = mass of adsorbent (kg)

K_d = distribution coefficient (L/kg)

C = equilibrium solute concentration (mg/l)

$1/n$ = constant

If a batch leach test is used, the following criteria shall be met:

(a) The batch leach test shall be used to determine the actual pore water concentration coming from contaminated material, not a diluted concentration.

(b) The batch leach tests shall model desorption rather than sorption.

(c) Measures shall be utilized to prevent biodegradation and volatilization both prior to and during leach testing.

(II) Calculating a site-specific dilution factor. The default dilution factor of 20 or a site-specific dilution factor (DF) may be calculated and used in

Equation 1 to calculate an unrestricted land use soil cleanup level that is protective of ground water. The site-specific dilution factor shall be calculated using:

Equation 5: $DF = (Q_p + Q_a) / Q_p$

Where,

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DF = Dilution factor

Qa = Ground water flow (m/year)

Qp = Volume of water infiltrating (m³/year)

(1) The volume of ground water flow, Qa, may be calculated using:

Equation 6: $Qa = K \times A \times I$

Where,

Qa = Ground water flow (m³/year)

K = Hydraulic conductivity (m/yr). Literature estimates or site-specific measurements may be used.

A = Aquifer mixing zone (m²). The aquifer mixing zone thickness shall not exceed 5 meters and the length shall be equal to the length of the contaminant source area parallel to ground water flow.

I = Gradient (m/m)

(2) The volume of water infiltrating, Qp, may be calculated using:

Equation 7: $Qp = L \times W \times I$

Where,

Qp = volume of water infiltrating (m/year)

L = length of contaminant source area parallel to ground water flow (m)

W = width of contaminant source area (m)

I = infiltration (m/yr). For sites west of the Cascades, infiltration estimates shall not be lower than 70 % of the average annual precipitation amount. For sites east of the Cascades, infiltration estimates shall not be lower than 25 % of the average annual precipitation amount.

(III) Using a computer model to derive a soil cleanup level that is protective of ground water. If a computer model is used to derive a soil cleanup level that is protective of ground water, it may include but shall not be limited to:

(1) A decaying source term to account for leaching over time.

(2) A dispersion term to account for solute transport within the vadose zone.

(3) An estimate of the biodegradation that may occur as contaminants migrate from the vadose zone to the saturated zone. If a soil biodegradation estimate is used, it shall be based upon site-specific measurements.

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(4) An estimate of infiltration that is based on site conditions without surface caps (e.g. pavement) or other structures that would control or impede infiltration.

(IV) Deriving unrestricted land use soil cleanup levels for petroleum hydrocarbons. Soil cleanup levels for petroleum hydrocarbons may be derived using two methods:

(A) A four-phase partitioning solution may be used to derive soil cleanup levels for petroleum hydrocarbons that may be present in soil as non-aqueous phase liquids (e.g. NAPL) or complex chemical mixtures.

(B) A site-specific residual saturation measurement may be used to derive soil cleanup levels that are protective of ground water. Use of this measurement is optional. However, soil petroleum hydrocarbon concentrations shall not be set at residual levels that could result in gravity drainage of the residual oil from the soil.

(I) Measuring the soil's petroleum content. A compositional analysis of the soil's petroleum content may be completed by analyzing for individual petroleum fractions (Table 5). Use of the four-phase partitioning approach is contingent upon accurate measurement of the soil's petroleum content and composition.

(1) Accounting for volatilization and biodegradation during soil sample collection. When collecting soil samples for laboratory analysis, measures that prevent volatilization and biodegradation shall be employed. These measures may include preservation of soil samples with methanol, addition of other preservatives that inhibit biological decay and use of special coring devices or sample containers.

(II) If a complex chemical mixture is present in the soil as a non-aqueous phase liquid (e.g. NAPL), the four-phase partitioning solution shall be used to estimate soil pore water concentrations. It may be assumed that NAPL is present if the soil petroleum concentrations in Table 2 have been exceeded.

Table 2: Chemical Saturation Values.

Fuel Fraction	Soil Chemical Saturation Concentration (mg/kg)
ALIPHATICS	
EC 5 - 6	102
EC > 6 - 8	34
EC > 8 - 10	13
EC > 10 - 12	7
EC > 12 - 16	3
EC > 16 - 21	1
AROMATICS	
Benzene (EC 5-7)	319
Toluene (EC >7-8)	182
EC > 8 - 10	111
EC > 10 - 12	65
EC > 12 - 16	30
EC > 16 - 21	8
EC > 21 - 35	1

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(III) Four-phase partitioning solution. If a petroleum hydrocarbon is present in the soil at concentrations greater than those given in Table 2, the four-phase partitioning solution may be used to estimate soil pore water concentrations:

Equation 8: $C = X_i S / DAF$

C = Estimated soil pore water concentration (mg/l)

X_i = Mole fraction (fraction or chemical molecular weight from Table 5 divided by 1)

S = Water solubility (mg/l, Table 5)

DAF = Dilution factor (20)

(1) Equation 8 must be solved iteratively for each fraction, e.g. a pore water concentration for each fraction must be calculated. The sum of all pore water concentrations must not exceed the ground water cleanup level.

(2) If the four-phase partitioning solution is applied to the saturated zone soil, a dilution factor of 1 shall be used.

(a) Accounting for soil petroleum residual saturation content. Measurements of the soil residual oil content may be made on a site-specific basis to derive soil cleanup levels that are protective of ground water. When measuring residual saturation, the following shall be accounted for:

(b) Chemical partitioning of the residual oil water soluble fraction. Some fuels, such as gasoline, contain a higher percentage of water soluble fraction components. Use of the four-phase partitioning solution shall be used to assess partitioning of the residual oil and any water soluble components.

(c) Gravity drainage of the residual oil from the unsaturated zone to the saturated zone. Soil cleanup levels that are based on residual saturation shall not be set at concentrations that could result in gravity drainage of the residual oil from the vadose zone to the saturated zone. If the soil petroleum concentrations in

Table 3 are exceeded, it may be assumed that gravity drainage of the residual oil could occur.

Table 3: Soil Residual Saturation.

Fuel	Acceptable Soil Concentration (mg/kg)
Gasoline	500
Middle Distillates (e.g. Diesel, No 2. Fuel Oil)	1,000
Heavy Fuel Oils (e.g. No 6. Fuel Oil)	1,000

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Mineral Oil	4,000
Unknown Composition or Type	500

(d) Differences between field and laboratory measurements of residual saturation. The Department anticipates that in most cases, laboratory measurements of residual saturation will exceed actual field measurements. This difference must be accounted for when deriving a soil cleanup level that is based on residual saturation.

(v) Deriving soil cleanup levels from leach tests. Two types of leaching test methods may be used to estimate a soil pore water concentration that is protective of ground water: the Synthetic Precipitation Leaching Procedure (EPA Method 1312) or the Toxicity Characteristic Leaching Procedure (EPA Method 1311).

(A) Leach test use. The TCLP and SPLP leach tests shall be used to derive unrestricted land use soil cleanup levels for the hazardous substances specified in

Table 4.

Table 4: Leach Test Criteria.

Test	Extraction Fluid	Appropriate For
TCLP	Fluid #1: Buffered acetic Acid, @ 4.93.	Metals, semi- volatiles, pesticides, PCB mixtures, volatile organics.
SPLP	Fluid #2: H ₂ SO ₄ & HNO ₃ @ pH 5.00 ± 0.05	Metals, semi- volatiles, pesticides, PCB mixtures.
SPLP	Fluid #3: Reagent Water	Cyanide, sulfides, volatile organics, hexavalent chromium, organic

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		compounds that are less soluble at low ph.
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(B) Leach test criteria. If the leach test eluant concentration is less than the Method B ground water cleanup level specified in Chapter 173-340-720 WAC, the soil hazardous substance concentration shall be considered protective of ground water. For cadmium, lead, and zinc, the eluant concentration from the TCLP shall be compared to a concentration that is equal to ten (10) times the Method B ground water cleanup level.

(C) Leach test protocols. When conducting leach tests, the criteria specified in 3(A)(iii) shall be met. Zero headspace extractors (ZHE) shall be used to minimize volatilization for appropriate hazardous substances (e.g. volatile organics). Solid-liquid separation shall be accomplished through settling or centrifugation and not filtering. The liquid removed for analysis shall be obtained using decanting procedures.

(D) Use of alternative leach tests. Other leaching tests, subject to Department approval, may be used to derive unrestricted land use soil cleanup levels that are protective of ground water. If an alternative leaching test is used, it shall meet the criteria specified in 3(A)(iii).

(d) Ground water monitoring. The Department may require ground water monitoring if soil cleanup levels have been based upon site-specific measurements (e.g. soil fraction or organic carbon content, distribution coefficient, dilution factor, biodegradation, etc.). The frequency and duration of such monitoring shall be decided on a case by case basis.

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Table 5: Petroleum Fraction Physical / Chemical Values.

Fuel Fraction	Equivalent Carbon Number	Water Solubility (mg/L)	Mol. Wt. (g/mol)	Henry's Constant (cc/cc)	Soil Organic Carbon Partitioning Coefficient Koc (L/kg)
ALIPHATICS					
EC 5 – 6	5.5	28.0	81.0	34.0	794
EC > 6 – 8	7.0	4.20	100.0	51.0	3,980
EC > 8 – 10	9.0	0.330	130.0	82.0	31,600
EC > 10 – 12	11.0	0.026	160.0	130	251,000
EC > 12 - 16	14.0	5.90E-04	200.0	540	5,010,000
EC > 16 - 21	19.0	1.00E-06	270.0	6,400	1.00E+09
AROMATICS					
Benzene (EC 5-7)	6.5	1,780	78.0	0.23	79.4
Toluene (EC >7-8)	7.6	520	92.0	0.27	251
EC > 8 – 10	9.0	65.0	120.0	0.49	1,580
EC > 10 - 12	11.0	25.0	130.0	0.14	2,510
EC > 12 - 16	14.0	5.8	150.0	0.054	5,010
EC > 16 - 21	19.0	0.51	190.0	0.013	15,800
EC > 21 - 35	28.0	6.6E-03	240.0	6.8E-04	126,000

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Table 6: Organic Chemical Soil Organic Carbon Partitioning Coefficient (Koc) Values.

Chemical	Koc (ml/g)	Chemical	Koc (ml/g)	Chemical
ACENAPTHENE	4,898	DIBENZO(a,h)ANTHRACENE	1,789,101	NITROBENZENE
ACETONE	1	DICAMBA	2.2	PARATHION
ACETOPHENONE	43	DICHLOROBENZENE-1,4-	511	PENTACHLOROPHI
ACRYLONITRILE	0.074	DICHLOROETHANE-1,1	53	PENTACHLOROBENZ
ALDRIN	48,685	DICHLOROETHYLENE-1,1	65	PHENOL
AMETRYN	389	DICHLOROPROPANE-1,2	47	PICLORAM
ANILINE	14.8	DICHLOROPROPENE-1,3	27	PYRENE
ANTHRACENE	23,493	DIELDRIN	25,546	QUINOLINE
AROCLOR 1016	107,285	DIETHYL PHTHALATE	82	SIMAZINE
AROCLOR 1260	822,422	DIMETHYL PHTHALATE	29	STYRENE
ATRAZINE	158	DINITROTOLUENE, 2,4-	62	TETRACHLOROBENZEN
BENZENE	62	DINITROTOLUENE, 2,6-	62	TETRACHLOROETHYL
BENZIDIENE	40	DIOXANE-1,4	1	TOLUENE
BENZO(a)ANTHRACENE	356,938	DIURON	562	TRICHLOROETHANE
BENZO(a)PYRENE	968,774	ENDRIN	8,318	TRICHLOROETHANE
BENZO(b)FLUORANTHENE	882,588	ENDOSULFAN	2,040	TRICHLOROETHYL
BENZO(k)FLUORANTHENE	2,020,971	ETHION	15,488	TOXAPHENE
BENZOIC ACID	64	ETHYL BENZENE	204	VINYL ACETAT
BIS(2-CHLOROETHYL)ETHER	76	ETHYL ETHER	8	VINYL CHLORID
BIS(2-ETHYLHEXYL)PHTHALATE	111,123	FLOUORANTHENE	49,096	XYLENE-o
BROMOFORM	126	FLUORENE	7,961	XYLENE-m
BUTYL BENZYL PHTHALATE	13,746	HEPTACHLOR	9,528	XYLENE-p
CARBOFURAN	29	HEXACHLOROBENZENE	80,000	
CARBON TETRACHLORIDE	152	HEXACHLOROCYCLOPENT.	4,265	
CHLORDANE	51,310	LINDANE	1,000	
CHLOROBENZENE	224	MALATHION	1,820	
CHLOROFORM	53	METHOXYCHLOR	80,000	
CHRYSENE	420,108	METHYL ETHYL KETONE	1.2	
CYANAZINE	200	METHYLENE CHLORIDE	10	
DDE	86,405	N,N'-DIMETHYLFORMAMIDE	1	
DDT	677,934	NAPHTHALENE	1,191	

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~~(iii) For those hazardous substances for which sufficiently protective health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:~~

(c) Soil Ingestion. Concentrations which, due to ingestion of contaminated soil, are estimated to result in no acute or chronic noncarcinogenic toxic effects on human health using a hazardous quotient of one (1) and concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1 X 10⁻⁶). The following equations and default exposure assumptions shall be used to conduct this calculation:

~~(A) Concentrations which are estimated to result in no acute or chronic toxic effects on human health via direct contact with contaminated soil and are determined using the following equation and standard exposure assumptions:~~

(i) For noncarcinogenic toxic effects::

$$\text{Soil Cleanup Level} = \frac{\text{RFD} \times \text{ABW} \times \text{UCF2} \times \text{HQ}}{\text{SIR} \times \text{AB1} \times \text{FOC}} \quad \text{[Equation 740-X]}$$

(mg/kg)

Where:

RFD = Reference Dose as defined in WAC 173-340-708(7) (mg/kg-day)
ABW = Average body weight over the period of exposure (16 kg)
UCF2 = Units conversion factor (1,000,000 mg/kg)
SIR = Soil ingestion rate (200 mg/day)
AB1 = Gastrointestinal absorption rate (1.0)
FOC = Frequency of contact (1.0)
HQ = Hazard quotient (1);

~~(B) Concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 1,000,000 via direct contact with contaminated soil and are determined using the following equation and standard exposure assumptions:~~

(ii) For carcinogenic effects:

$$\text{Soil Cleanup Level} = \frac{\text{RISK} \times \text{ABW} \times \text{LIFE} \times \text{UCF1}}{\text{CPF} \times \text{SIR} \times \text{AB1} \times \text{DUR} \times \text{FOC}} \quad \text{[Equation 740-X]}$$

(mg/kg)

Where:

RISK = Acceptable cancer risk level (1 in 1,000,000)
ABW = Average body weight over the period of exposure (16 kg)
LIFE = Lifetime (75 years)
UCF1 = Unit conversion factor (1,000,000 mg/kg)
CPF = Carcinogenic Potency Factor as defined in WAC 173-340-708(8)

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(kg-day/mg)

SIR = Soil ingestion rate (200 mg/day)
AB1 = Gastrointestinal absorption rate (1.0)
DUR = Duration of exposure (6 years)
FOC = Frequency of contact (1.0);

(f) Dermal contact. Concentrations which, due to dermal contact with contaminated soil, are estimated to result in no acute or chronic noncarcinogenic toxic effects on human health using a hazardous quotient of one (1) and concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}). The dermal pathway shall be included when establishing soil cleanup levels for the following hazardous substances: arsenic, cadmium, chlordane, 2,4-dichlorophenoxy acetic acid (2,4-D), dichlorodiphenyltrichloroethane (DDT), tetrachlorodibenzo-p-dioxin (TCDD), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) [when evaluating risk using fractions], and pentachlorophenol. For other hazardous substances, the dermal pathway shall be considered in the evaluation when proposed changes to the default equations and values would result in soil cleanup levels or remediation levels that are substantially in excess of those calculated using the default methods (i.e. generally, a factor of 2 or more). The department may require evaluation of this pathway in other circumstances where necessary to protect human health. When evaluating the dermal pathway, it shall be considered additive to the soil ingestion pathway and the resultant soil cleanup levels adjusted downward in accordance with subsection (6) of this section. The following equations and default exposure assumptions shall be used to conduct this calculation:

(i) For noncarcinogenic hazardous substances:

$$\text{Soil Cleanup Level} = \frac{(\text{HQ})(\text{RfDd})(\text{BW})(\text{AT})(365 \text{ days/yr})(10^6 \text{ mg/kg})}{(\text{mg/kg})(\text{ED})(\text{EV})(\text{EF})(\text{SA})(\text{AF})(\text{ABS})}$$

Where:

HQ = Hazard quotient (1)(unitless)
RfDd = Oral reference dose adjusted for dermal pathway (mg/kg/day)
BW = Body weight (16 kg)
AT = Averaging time (6 years)
ED = Exposure duration (6 years)
EV = Event frequency (1 event per day)
EF = Exposure frequency (350 days/year)
SA = Exposed skin surface area (3400 cm²)
AF = Adherence factor (0.8 mg/cm²-event)
ABS = Absorption fraction (unitless)(chemical specific)

(ii) For carcinogenic hazardous substances:

$$\text{Soil Cleanup Level} = \frac{(\text{RISK})(\text{BW})(\text{AT})(365 \text{ days/yr})(10^6 \text{ mg/kg})}{(\text{mg/kg})(\text{SFd})(\text{ED})(\text{EV})(\text{EF})(\text{SA})(\text{AF})(\text{ABS})}$$

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Where:

RISK	=	Acceptable cancer risk level (1×10^{-6})(unitless)
SFd	=	Cancer slope factor adjusted for dermal pathway (mg/kg/day)
BW	=	Body weight (16 kg)
AT	=	Averaging time (75 years)
ED	=	Exposure duration (6 years)
EV	=	Event frequency (1 event per day)
EF	=	Exposure frequency (350 days/year)
SA	=	Exposed skin surface area (3400 cm^2)
AF	=	Adherence factor ($0.8 \text{ mg/cm}^2\text{-event}$)
ABS	=	Absorption fraction (unitless)(chemical specific)

~~(iv) To assure that unacceptable risks do not result from inhalation of hazardous substances in or released from contaminated soils, soil concentrations which ensure that releases of hazardous substances shall not result in ambient air concentrations which exceed method B cleanup levels established under WAC 173-340-750.~~

(g) Soil Vapors. Soil with volatile hazardous substances shall not cause ambient air and air within structures to exceed air cleanup levels established under WAC 173-340-750. Generally, chemicals where this is a concern are those with a molecular weight less than or equal to 200 grams/mole OR a Henry's Law constant greater than or equal to $10^{-3} \text{ atm-m}^3/\text{mole}$. For petroleum contamination, this is generally both aromatic and aliphatic constituents up to and including EC 16 and any additional, individual constituents which meet the above molecular weight and Henry's Law constant criteria. The following methods may be used to demonstrate compliance with this requirement:

(i) Measurements of the soil vapor concentrations, using methods approved by the department, demonstrating vapors in the soil do not exceed air cleanup levels established under WAC 173-340-750;

(ii) Gasoline range hydrocarbons. Measurements of soil concentrations, using methods approved by the department, that do not exceed 100 mg/kg and 0.5 mg/kg for TPH and benzene respectively

(iii) Diesel range hydrocarbons. Measurements of soil concentrations, using methods approved by the department, that do not exceed 200 mg/kg.

(iv) Using an active vapor extraction system with off-gas capture or treatment (e.g. granular activated carbon or thermal treatment of off-gas). The system shall be operated until soil vapor concentrations no longer exceed air cleanup level established under WAC 173-340-750 or the soils no longer exceed the soil cleanup levels above or as long as effective reductions in concentrations or plume size are occurring including the use of pulsed pumping.

(v) Using modeling methods approved by the department and demonstrating the vapor concentrations in the ambient air and air within structures will not exceed the air cleanup levels established under WAC 173-340-750. When this method is used, the department may require soil vapor and/or air monitoring shall be conducted to verify the calculations and compliance with air cleanup levels. The following approaches may be used to calculate a soil cleanup level that is protective of ambient air and air within structures:

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(A) Subsurface soil to subsurface structures. The default approach to this route shall include diffusion and advective flow in a porous media. It may also account for any resistance to flow that is provided by the floor or foundation of the enclosed space and mixing within the building. The Johnson and Ettinger model combined with a fixed-box mixing term inside the building includes these elements and may be used. Ecology may approve other methods if it determines the methods adequately model transport mechanisms.

(B) Surface soil to ambient air. The default approach to this route shall include diffusion flow in a porous media and may include mixing in ambient air. The Jury infinite and finite models combined with EPA's Q/C term includes these elements and may be used. A decision on the use of infinite or finite source calculations should be based on conditions at the site and which equation will most accurately estimate air concentrations. Ecology may approve other methods if it determines the methods adequately model transport mechanisms.

(C) Ecology may require other approaches for evaluating vapor transport where the above methods do not adequately protect human health or the environment.

(h) Environmental Protection. Concentrations which result in no significant adverse effects on the protection and propagation of vegetation or wildlife established using the procedures specified in WAC 173-340-709.

(b) (4) The department may establish method B cleanup levels that are more stringent than those required under (a) of this subsection (3), when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health or environment including the following: Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-708. ;

(i) (a) Concentrations which eliminate or substantially reduce the potential for food chain contamination;

(ii) (b) Concentrations which eliminate or substantially reduce the potential for damage to soils or biota in the soils which could impair the use of soils for agricultural or silvicultural purposes; and,

(iii) Concentrations which eliminate or substantially reduce the potential for adverse effects on vegetation or wildlife;

(iv) Concentrations more stringent than those in (b) of this subsection where the department determines that such levels are necessary to protect the ground water at a particular site;

(v) (c) Concentrations necessary to protect nearby surface waters from hazardous substances in runoff from the site; and

(vi) Concentrations which eliminate or minimize the potential for the accumulation of vapors in buildings or other structures to concentrations which pose a threat to human health or the environment.

(4) (5) Method C cleanup levels. This section does not provide procedures for establishing method C soil cleanup levels. Except for qualifying industrial properties, Methods A and B are the only methods available for establishing soil cleanup levels at sites.

(a) Method C soil cleanup levels may be utilized if the person conducting the cleanup action can demonstrate that such levels are consistent with applicable state and federal laws, that all practicable methods of treatment have been utilized, that institutional controls are implemented in accordance with WAC 173-340-440, and that one or more of the conditions in WAC 173-340-706 (1)(a) exist.

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~~(b) Method C cleanup levels for soils shall be at least as stringent as all of the following:~~

~~(i) Concentrations established under applicable state and federal laws;~~

~~(ii) Concentrations which will not cause contamination of ground water at levels which exceed ground water cleanup levels established under WAC 173-340-720 as determined using the following procedures:~~

~~(A) For individual hazardous substances or mixtures, concentrations that are equal to or less than one hundred times the ground water cleanup level established in accordance with WAC 173-340-720 unless it can be demonstrated that a higher soil concentration is protective of ground water at the site;~~

~~(B) For total petroleum hydrocarbons, the person undertaking the cleanup may elect to make this demonstration on the basis of data on individual hazardous substances that comprise the total petroleum hydrocarbons;~~

~~(iii) For those hazardous substances for which health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:~~

~~(A) Concentrations which are anticipated to result in no significant acute or chronic toxic effects on human health and estimated in accordance with WAC 173-340-740 (3)(a)(iii)(A) except that the frequency of contact shall be 0.5, the soil ingestion rate shall be 100 milligrams per day, and the average body weight shall be 16 kilograms;~~

~~(B) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 100,000 and are estimated in accordance with WAC 173-340-740 (3)(a)(iii)(B) except that the frequency of contact shall be 0.5 and the soil ingestion rate shall be 100 milligrams per day; and~~

~~(iv) To assure that unacceptable risks do not result from inhalation of hazardous substances in or released from contaminated soils, soil concentrations which ensure that releases of hazardous substances shall not result in ambient air concentrations which exceed method C cleanup levels established under WAC 173-340-750.~~

~~(C) The department may establish method C cleanup levels that are more stringent than those required by (a) through (c) of this subsection when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment, including consideration of those factors listed in subsection (3)(b) of this section.~~

~~(5) Multiple hazardous substances/multiple pathways of exposure.~~

~~(6) Adjustments to cleanup levels.~~

~~(a) Total site risk adjustments. Soil cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including cleanup levels based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures specified in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}).~~

~~(b) Adjustments to ARARs. These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including cleanup levels based on applicable state and federal laws. Where a cleanup level developed under subsection (2) or (3) of this section is based on an applicable state or federal law and the level of risk upon which the~~

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standard is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}) and the hazard index does not exceed one (1) at the site.

(c) Natural background and PQL considerations. Cleanup levels determined under subsections (2) and (3) of this section, including cleanup levels adjusted under provisions (5)(a) and (5)(b) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

~~(6)~~ (7) Point of compliance.

(a) The point of compliance is the point or points where the soil cleanup levels established under subsections (2), (3), ~~(4)~~, and (5) of this section shall be attained.

(b) For soil cleanup levels based on the protection of ground water, the point of compliance shall be established in the soils throughout the site.

(c) For soil cleanup levels based on human exposure via direct contact, the point of compliance shall be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities.

(d) The department recognizes that, for those cleanup actions selected under WAC 173-340-360 that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified in (b) and (c) of this subsection. In these cases, the cleanup action may be determined to comply with cleanup standards, provided the compliance monitoring program is designed to ensure the long-term integrity of the containment system, a site-specific human health risk assessment demonstrates the remedy is protective, the remedy is demonstrated under WAC 173-340-709 to be ecologically protective, and the other requirements for containment technologies in WAC 173-340-360(8) are met.

~~(7)~~ (8) Compliance monitoring.

(a) Compliance with soil cleanup levels shall be based on total analyses of the soil fraction less than two millimeters in size. When it is reasonable to expect that larger soil particles could be reduced to two millimeters or less during current or future site use and this reduction could cause an increase in the concentrations of hazardous substances in the soil, soil cleanup levels shall also apply to these larger soil particles. Compliance with soil cleanup levels shall be based on dry weight concentrations. The department may approve the use of alternate procedures for stabilized soils.

(b) Sampling and analytical procedures shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. The sample design shall provide data which are representative of the area where exposure to hazardous substances may occur.

(c) The data analysis and evaluation procedures used to evaluate compliance with soil cleanup levels shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. These procedures shall meet the following general requirements:

(i) Methods of data analysis shall be consistent with the sampling design. Separate methods may be specified for surface soils and deeper soils;

(ii) When cleanup levels are based on requirements specified in applicable state and federal laws, the procedures for evaluating compliance that are specified in those

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requirements shall be utilized to evaluate compliance with cleanup levels unless those procedures conflict with the intent of this section;

(iii) Where procedures for evaluating compliance are not specified in an applicable state and federal law, statistical methods shall be appropriate for the distribution of sampling data for each hazardous substance. ~~If the distribution of sampling data for a hazardous substance is inappropriate for statistical methods based on a normal distribution, then the data may be transformed.~~ Sampling data shall be assumed to be lognormally distributed unless it can be demonstrated another distribution is more appropriate. If the distributions for hazardous substances differ, more than one statistical method may be required; and

(iv) The data analysis plan shall specify which parameters are to be used to determine compliance with soil cleanup levels.

(A) For cleanup levels based on short-term or acute toxic effects on human health or the environment, an upper percentile soil concentration shall be used to evaluate compliance with cleanup levels.

(B) For cleanup levels based on chronic or carcinogenic threats, the mean soil concentration shall be used to evaluate compliance with cleanup levels unless there are large variations in hazardous substance concentrations relative to the mean hazardous substance concentration or a large percentage of concentrations are below the detection limit.

(d) Appropriate statistical methods include the following:

(i) A procedure in which a confidence interval for each hazardous substance is established from site sampling data and the soil cleanup level is compared to the upper confidence interval;

(ii) A parametric test for percentiles based on tolerance intervals to test the proportion of soil samples having concentrations less than the soil cleanup level; or

(iii) Other statistical methods approved by the department.

(e) If a confidence interval approach is used to evaluate compliance with a soil cleanup level, the decision rule is a one-tailed test of the null hypothesis that the true soil concentration of a hazardous substance exceeds the soil cleanup level. Compliance with soil cleanup levels shall be determined using the following criteria:

(i) The upper confidence interval on the true soil concentration is less than the soil cleanup level. Statistical tests shall be performed at a Type I error level of 0.05;

(ii) No single sample concentration shall be greater than two times the soil cleanup level; and

(iii) Less than ten percent of the sample concentrations shall exceed the soil cleanup level.

(f) If a method to test the proportion of soil samples is used to evaluate compliance with a soil cleanup level, compliance shall be determined using the following criteria:

(i) No single sample concentrations shall be greater than two times the soil cleanup level; and

(ii) Less than ten percent of the sample concentrations shall exceed the soil cleanup level; (This requirement shall not apply when the soil cleanup level is based on natural background) and

(iii) The true proportion of samples that do not exceed the soil cleanup level shall not be less than ninety percent. Statistical tests shall be performed with a Type I error level of 0.05.

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(g) For purposes of demonstrating compliance with soil cleanup levels, measurements below the method detection limit shall be assigned a value equal to one-half the method detection limit. Detectable levels below the practical quantitation limit shall be assigned a value equal to the method detection limit. The department may approve alternate statistical procedures for handling nondetected values or values below the practical quantitation limit. Alternate statistical procedures may include probit analysis and regression analysis.

WAC 173-340-745 Soil Cleanup Standards for Industrial Properties. (1) General considerations.

(a) Use of this section. This section shall be used to establish soil cleanup levels where the department has determined that industrial land use represents the reasonable maximum exposure. Soil cleanup levels for qualifying industrial properties shall be determined using the procedures described in WAC 173-340-740 or in subsections (2) and (4) of this section. In the event of a release of a hazardous substance, a cleanup action complying with WAC 173-340-360 shall be conducted to address those soils with hazardous substance concentrations which exceed these soil cleanup levels.

(b) Criteria. Cleanup levels shall not be based on industrial land use unless the following criteria can be demonstrated:

(i) The area of the site where industrial property soil cleanup levels are proposed meets the definition of an industrial property under WAC 173-340-200;

Industrial soil cleanup levels are based on an adult worker exposure scenario. It is essential to evaluate land uses and zoning for compliance with this definition in the context of this exposure scenario. Local governments use a variety of zoning categories for industrial land uses so a property does not necessarily have to be in a zone called "industrial" to meet the definition of "industrial property." Also, there are land uses allowed in industrial zones that are actually commercial or residential, rather than industrial, land uses. Thus, an evaluation to determine compliance with this definition should include a review of the actual text in the comprehensive plan and zoning ordinance pertaining to the site and a visit to the site to observe land uses in the zone. When evaluating land uses to determine if a property use not specifically listed in the definition is a "traditional industrial use" or to determine if the property is "zoned for industrial use," the following characteristics shall be considered:

- People do not normally live on industrial property. The primary potential exposure is to adult employees of businesses located on the industrial property;
- Access to industrial property by the general public is generally not allowed. If access is allowed, it is highly limited and controlled due to safety or security considerations;
- Food is not normally grown/raised on industrial property. (However, food processing operations are commonly considered industrial facilities);
- Operations at industrial properties are often (but not always) characterized by use and storage of chemicals, noise, odors and truck traffic;
- The surface of the land at industrial properties is often (but not always) mostly covered by buildings or other structures, paved parking lots, paved access roads and material storage areas, minimizing potential exposure to the soil;

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- Industrial properties may have support facilities consisting of offices, restaurants, and other facilities that are commercial in nature but are primarily devoted to administrative functions necessary for the industrial use and/or are primarily intended to serve the industrial facility employees and not the general public;

(ii) The cleanup action provides for appropriate institutional controls implemented in accordance with WAC 173-340-440 to limit potential exposure to residual hazardous substances. This shall include, at a minimum, placement of a covenant on the property restricting use of the area of the site where industrial soil cleanup levels are proposed to industrial property uses; and

(iii) Hazardous substances remaining at the property after remedial action would not pose a threat to human health or the environment at the site or in adjacent nonindustrial areas. In evaluating compliance with this criterion, at a minimum the following factors shall be considered:

- The potential for access to the industrial property by the general public, especially children. The proximity of the industrial property to residential areas, schools or childcare facilities shall be considered when evaluating access. In addition, the presence of natural features, manmade structures, arterial streets or intervening land uses that would limit or encourage access to the industrial property shall be considered. Fencing shall not be considered sufficient to limit access to an industrial property since this is insufficient to assure long term protection;
- The degree of reduction of potential exposure to residual hazardous substances by the selected remedy. Where the residual hazardous substances are to be capped to reduce exposure, consideration shall be given to the thickness of the cap and the likelihood of future site maintenance activities, utility and drainage work, or building construction reexposing residual hazardous substances.
- The potential for transport of residual hazardous substances to off-property areas, especially residential areas, schools and childcare facilities;
- The potential for significant adverse effects on vegetation or wildlife caused by residual hazardous substances using the procedures in WAC 173-340-709; and
- The likelihood that these factors would not change for the foreseeable future.

(c) Ecology expectations. In applying the criteria in WAC 173-340-745 (1)(b), the department expects the following results:

(i) The department expects that properties zoned for heavy industrial or high intensity industrial use and located within a city or county having completed a comprehensive plan and adopted implementing zoning regulations under the Growth Management Act (chapter 36.70A RCW) will meet the definition of industrial property. For cities and counties not planning under the Growth Management Act, the department expects that spot zoned industrial properties will not meet the definition of industrial property but that properties that are part of a larger area zoned for heavy industrial or high intensity industrial use will meet the definition of an industrial property;

(ii) For both GMA and non-GMA cities and counties, the department expects that light industrial and commercial zones and uses should meet the definition of industrial property where the land uses are comparable to those cited in the definition of industrial property or the land uses are an integral part of a qualifying industrial use (such as,

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ancillary or support facilities). This will require a site-by-site evaluation of the zoning text and land uses;

(iii) The department expects that for portions of industrial properties in close proximity to (generally, within a few hundred feet) residential areas, schools or childcare facilities, residential soil cleanup levels will be used unless:

(A) Access to the industrial property is very unlikely or, the hazardous substances that are not treated or removed are contained under a cap of clean soil (or other materials) of substantial thickness so that it is very unlikely the hazardous substances would be disturbed by future site maintenance and construction activities (depths of even shallow footings, utilities and drainage structures in industrial areas are typically three to six feet); and

(B) The hazardous substances are relatively immobile (or have other characteristics) or have been otherwise contained so that subsurface lateral migration or surficial transport via dust or runoff to these nearby areas or facilities is highly unlikely; and

(iv) Note that a change in the reasonable maximum exposure to industrial site use primarily affects the direct contact exposure pathway. Thus, for example, for sites where the soil cleanup level is based primarily on the potential for the hazardous substance to leach and cause ground water contamination, it is the department's expectation that an industrial land use will not affect the soil cleanup level. Similarly, where the soil cleanup level is based primarily on surface water protection, ecological or other pathways other than direct human contact, land use is not expected to affect the soil cleanup level.

(d) Calculating industrial property soil cleanup levels. Soil cleanup levels established under this section shall be determined as described in subsections (2) through (5) of this section.

(e) Soil cleanup levels for nearby properties. Soil cleanup levels for areas beyond the industrial property boundary that do not qualify for industrial soil cleanup levels under this section (including implementation of institutional controls and a covenant restricting use of the property to industrial property uses) shall be established in accordance with WAC 173-340-740.

(f) Relationship between soil cleanup levels and other cleanup standards. Soil cleanup levels shall be established at concentrations which do not directly or indirectly cause violations of ground water, surface water, sediment or air cleanup standards established under this chapter or under applicable state and federal laws. A property that qualifies for an industrial soil cleanup level under this section does not necessarily qualify for other than a Method A or Method B cleanup level in other media. Each medium must be evaluated separately utilizing the criteria applicable to that medium.

(g) Other options. See WAC 173-340-740 (1)(c) for establishing cleanup levels for industrial land uses not qualifying under this section and for commercial land uses.

(2) Method A industrial soil cleanup levels. Method A industrial soil cleanup levels may be used at any qualifying industrial property, subject to the limitations noted in WAC 173-340-705 and footnote a of table 745-1.

(a) Method A industrial soil cleanup levels shall be at least as stringent as all of the following:

(i) Concentrations in ~~the following~~ table 745-1:

(ii) Concentrations established under applicable state and federal laws ;

(b) For sites with additional hazardous substances which are deemed indicator hazardous substances under WAC 173-340-708(2) for which there is no value in Table 3 745-1 or applicable state and federal laws, cleanup levels for these additional hazardous

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substances shall be established at the natural background concentration or the practical quantification limit, subject to the limitations in this chapter. [NOTE: Users should consider using method B, rather than method A, to establish cleanup levels at these sites.]

(c) The department may establish method A cleanup levels that are more stringent than those required by (a) of this subsection when, based on site-specific evaluations, the department determines that such levels are necessary to protect human health or environment, including consideration of the factors in WAC 173-340-740 (3)(b). Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.

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Table 3 745-1
Method A Cleanup Levels - Industrial Soil^a

Hazardous Substance	CAS Number	Cleanup Level mg/kg	Tier II Eco Sites ^{a2}
Arsenic	7440-38-2	200.0 mg/kg ^b	20 mg/kg
Benzene	71-43-2	0.5 mg/kg^e 0.02 ^c	
Cadmium	7440-43-9	10.0 mg/kg^d 8.0 ^d	
Chromium (Total)	7440-47-3	500.0 mg/kg ^e	135 mg/kg
Chromium (hexavalent)	18540-29-9	30 ^{e1}	
Copper	7440-50-8	600 ^{e2}	550 mg/kg
DDT	50-29-3	5.0 mg/kg^f 2.0 ^f	1 mg/kg
1,2 Dichloroethane	107-06-2	0.005 ^{f2}	
1,1 Dichloroethylene	75-35-4	0.06 ^{f3}	
Ethylbenzene	100-41-4	20.0 mg/kg ^g	
Ethylene dibromide (EDB)	106-93-4	0.001 mg/kg^h 0.002 ^h	
Lead	7439-92-1	1000.0 mg/kg ⁱ	220 mg/kg
Lindane	58-89-9	20.0 mg/kg^j 0.002 ^j	
Methylene chloride	75-09-2	0.5 mg/kg^k 0.02 ^k	
Mercury (inorganic)	7439-97-6	1.0 mg/kg ^l	
MTBE	1634-04-4	0.1 ^{l2}	
PAHs (carcinogenic)		20.0 mg/kg ^m	
PCB Mixtures		10.0 mg/kg^{n**}	1mg/kg
Pentachlorophenol	87-86-5	3.0 ⁿ²	
Tetrachloroethylene	127-18-4	0.5 mg/kg^o 0.05 ^o	
Toluene	108-88-3	40.0 mg/kg ^p	
TPH (gasoline)		100.0 mg/kg ^q	**
TPH (diesel)		200.0 mg/kg ^{r1}	
TPH (mineral oil)		2000 mg/kg ^{r2**}	
TPH (other) (heavy fuel & lubricating oils, other)		200.0 mg/kg ^s	**
1,1,1 Trichloroethane	71-55-6	20.0 mg/kg^t 2.0 ^{l1}	
1,1,2 Trichloroethane	79-00-5	0.005 ^{t2}	
Trichloroethylene	79-01-5	0.5 mg/kg^u 0.03 ^{u1}	
Vinyl Chloride	75-01-4	0.002 ^{u2}	
Xylenes	1330-20-7	20.0 mg/kg^v 80 ^v	
Zinc	7440-66-6	6000 ^w	570 mg/kg

** Value currently under evaluation.

^a Caution on misusing method A tables ~~this table~~. Method A tables have ~~This table~~ been developed for specific purposes. They are ~~is~~ intended to provide conservative cleanup levels that are protective at most, but not all, qualifying industrial sites, for sites undergoing

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~~routine cleanup actions or those sites with relatively few hazardous substances. The tables may not be appropriate for defining cleanup levels at other sites. For example, the values in this table may not provide protective cleanup levels at ecologically sensitive tier III sites, at site impacting surface water or sites where the additive effects of multiple contaminants needs to be considered. For these reasons, the values in these tables this table should not automatically be used to define cleanup levels that must be met for financial, real estate, insurance coverage or placement, or similar transactions or purposes. Exceedances of the values in these tables this table do not necessarily trigger requirements for cleanup actions under this chapter. A decision on whether cleanup of contamination is necessary should be made using the process described in WAC 173-340-360.~~

- ^{a2} The value in this column is to be used at sites classified as ecological tier II sites (see WAC 173-340-709).
- ^b Arsenic. Cleanup level based on concentration derived using the procedures in subsection (4)(a)(iii)(B). This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm arsenic contamination at this level does not have the potential to contaminate ground water.
- ^c Benzene. Cleanup level based on protection of ground water.
- ^d Cadmium. Cleanup level based on protection of ground water.
- ^{e1} Chromium (total). Cleanup level based on inhalation exposure.
- ^{e2} Chromium (hexavalent). Cleanup level based on protection of ground water.
- ^{e3} Copper. Cleanup level based on protection of ground water. This value may not be protective if the impacted ground water discharges to nearby surface water since aquatic organisms tend to be more sensitive than humans to copper.
- ^{f1} DDT. Cleanup level based on protection of ground water.
- ^{f2} 1,2 Dichloroethane. Cleanup level based on protection of ground water adjusted for practical quantitation limit.
- ^{f3} 1,1 Dichloroethylene. Cleanup level based on protection of ground water.
- ^g Ethylbenzene. Cleanup level based on protection of ground water.
- ^h Ethylene dibromide (EDB). Cleanup level based on protection of ground water
- ⁱ Lead. Cleanup level based on direct contact. This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm lead contamination at this level does not have the potential to contaminate ground water.
- ^j Lindane. Cleanup level based on ~~concentration derived using the procedures in subsection (3)(a)(iii)(B) of this section~~ protection of ground water.
- ^k Methylene chloride. Cleanup level based on protection of ground water.

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- ¹ Mercury. Cleanup level based on protection of ground water.
- ^m PAHs (carcinogenic). Cleanup level based on concentration derived using the procedures in subsection (4)(a)(iii)(B) of this section. This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm PAH contamination at this level does not have the potential to contaminate ground water.
- ⁿ¹ PCB Mixtures. Cleanup level based on concentration derived using the procedures in subsection (4)(a)(iii)(B) of this section. This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm PCB contamination at this level does not have the potential to contaminate ground water.
- ⁿ² Pentachlorophenol. Cleanup level based on protection of ground water adjusted for the practical quantitation limit. This value may not be protective of ground water and soil sampling with depth and ground water monitoring should be conducted to confirm lead contamination at this level does not have the potential to contaminate ground water.
- ^o Tetrachloroethylene. Cleanup level based on protection of ground water.
- ^p Toluene. Cleanup level based on protection of ground water.
- ^q Total Petroleum Hydrocarbons (gasoline). Cleanup level based on protection of ground water.
- ^{r1} Total Petroleum Hydrocarbons (diesel). Cleanup level based on protection of ground water. **[NOTE: Preliminary modeling indicates this value may not be protective of ground water or vapor pathways. (that modeling suggests this value should be reduced to 10 ppm)]**
- ^{r2} Total Petroleum Hydrocarbons (mineral oil). Cleanup level based on protection of ground water. **[This value is a reflection of current Ecology policy. BPA has recommended a value of 4000 ppm.]**
- ^s Total Petroleum Hydrocarbons (other). Cleanup level based on protection of ground water. **[NOTE: Depending on how this product is defined, residual saturation considerations suggest this value could be increased to 1000 ppm and still be protective of ground water]**
- ^{t1} 1,1,1 Trichloroethane. Cleanup level based on protection of ground water.
- ^{t2} 1,1,2 Trichloroethane. Cleanup level based on protection of ground water adjusted for practical quantitation limit.
- ^{u1} Trichloroethylene. Cleanup level based on protection of ground water.
- ^{u2} Vinyl Chloride. Cleanup level based on protection of ground water adjusted for practical quantitation limit.
- ^v Xylenes. Cleanup level based on protection of ground water; ~~and~~

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^w Zinc. Cleanup level based on protection of ground water.

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(3) Method B cleanup levels. This section does not provide procedures for establishing method B cleanup levels. Method C is the standard method for establishing soil cleanup levels at industrial sites and its use is conditioned upon the continued use of the site for industrial purposes.

(4) Method C cleanup levels.

(a) Method C cleanup levels for industrial soils shall be at least as stringent as all of the following:

(i) ARARs. Concentrations established under applicable state and federal laws ;

(ii) Ground water protection. Concentrations which will not cause contamination of ground water to concentrations which exceed ground water cleanup levels established under WAC 173-340-720 as determined using the following procedures in WAC 173-340-740(3)(b). ÷

~~—— (A) For individual hazardous substances or mixtures, concentrations that are equal to or less than one hundred times the ground water cleanup level established in accordance with WAC 173-340-720 unless it can be demonstrated that higher soil concentrations are protective of ground water at the site;~~

~~—— (B) For total petroleum hydrocarbons, the person undertaking the cleanup action may elect to make this demonstration on the basis of data on individual hazardous substances that comprise the total petroleum hydrocarbons;~~

~~(iii) For those hazardous substances for which sufficiently protective health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:~~

(iii) Soil Ingestion. Concentrations which, due to ingestion of contaminated soil, are estimated to result in no acute or chronic noncarcinogenic toxic effects on human health using a hazardous quotient of one (1) and concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one hundred thousand (1 X 10⁻⁵). The following equations and default exposure assumptions shall be used to conduct this calculation:

~~(A) Concentrations which are anticipated to result in no acute or chronic toxic effects on human health via direct contact with contaminated soil and are determined using the following equation and standard exposure assumptions:~~

(A) For noncarcinogenic toxic effects:

$$\text{Soil Cleanup Level} = \frac{\text{RFD} \times \text{ABW} \times \text{UCF2} \times \text{HQ}}{(\text{mg/kg}) \quad \text{SIR} \times \text{AB1} \times \text{FOC}} \quad \text{[Equation 745-1]}$$

Where:

RFD = Reference Dose as specified in WAC 173-340-708(7) (mg/kg-day)
ABW = Average body weight over the period of exposure (70 kg)
UCF2 = Unit conversion factor (1,000,000 mg/kg)
SIR = Soil ingestion rate (50 mg/day)
AB1 = Gastrointestinal absorption rate (1.0)
FOC = Frequency of contact (0.4)
HQ = Hazard quotient (1);

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~~(B) Concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 100,000 via direct contact with contaminated soil and are determined using the following equation and standard exposure assumptions:~~

(B) For carcinogenic effects:

$$\text{Soil Cleanup Level} = \frac{\text{RISK} \times \text{ABW} \times \text{LIFE} \times \text{UCFI}}{\text{CPF} \times \text{SIR} \times \text{AB1} \times \text{DUR} \times \text{FOC}} \quad \text{[Equation 745-2]}$$

(mg/kg)

Where:

RISK = Acceptable cancer risk level (1.0 in 100,000)
ABW = Average body weight over the period of exposure (70 kg)
LIFE = Lifetime (75 years)
UCF1 = Units conversion factor (1,000,000 mg/kg)
CPF = Carcinogenic Potency Factor as specified in WAC 173-340-708(8) (kg-day/mg)
SIR = Soil ingestion rate (50 mg/day)
AB1 = Gastrointestinal absorption rate (1.0)
DUR = Duration of exposure (20 years)
FOC = Frequency of contact (0.4);

(iv) Dermal contact. Concentrations which, due to dermal contact with contaminated soil, are estimated to result in no acute or chronic noncarcinogenic toxic effects on human health using a hazardous quotient of one (1) and concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}). The dermal pathway shall be included when establishing soil cleanup levels for the following hazardous substances: arsenic, cadmium, chlordane, 2,4-dichlorophenoxy acetic acid (2,4-D), dichlorodiphenyltrichloroethane (DDT), tetrachlorodibenzo-p-dioxin (TCDD), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) [when evaluating risk using fractions] and pentachlorophenol. For other hazardous substances, the dermal pathway shall be considered in the evaluation when proposed changes to the default equations and values would result in soil cleanup levels or remediation levels that are substantially in excess of those calculated using the default methods (i.e. generally, a factor of 2 or more). The department may require evaluation of this pathway in other circumstances where necessary to protect human health. When evaluating the dermal pathway, it shall be considered additive to the soil ingestion pathway and the resultant soil cleanup levels adjusted downward in accordance with subsection (6) of this section. The following equations and default exposure assumptions shall be used to conduct this calculation:

(A) For noncarcinogenic hazardous substances:

$$\text{Soil Cleanup Level} = \frac{(\text{HQ})(\text{RfDd})(\text{BW})(\text{AT})(365 \text{ days/yr})(10^6 \text{ mg/kg})}{(\text{ED})(\text{EV})(\text{EF})(\text{SA})(\text{AF})(\text{ABS})}$$

(mg/kg)

Where:

HQ = Hazard quotient (1)(unitless)
RfDd = Oral reference dose adjusted for dermal pathway (mg/kg/day)

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BW	=	Body weight (70 kg)
AT	=	Averaging time (6 years)
ED	=	Exposure duration (20 years)
EV	=	Event frequency (1 event per day)
EF	=	Exposure frequency (350 days/year)
SA	=	Exposed skin surface area (6600 cm ²)
AF	=	Adherence factor (0.2 mg/cm ² -event)
ABS	=	Absorption fraction (unitless)(chemical specific)

(B) For carcinogenic hazardous substances:

$$\text{Soil Cleanup Level} = \frac{(\text{RISK})(\text{BW})(\text{AT})(365 \text{ days/yr})(10^6 \text{ mg/kg})}{(\text{mg/kg}) (\text{SFd})(\text{ED})(\text{EV})(\text{EF})(\text{SA})(\text{AF})(\text{ABS})}$$

Where:

RISK	=	Acceptable cancer risk level (1 X 10 ⁻⁵)(unitless)
SF _d	=	Cancer slope factor adjusted for dermal pathway (mg/kg/day)
BW	=	Body weight (70 kg)
AT	=	Averaging time (75 years)
ED	=	Exposure duration (20 years)
EV	=	Event frequency (1 event per day)
EF	=	Exposure frequency (350 days/year)
SA	=	Exposed skin surface area (6600 cm ²)
AF	=	Adherence factor (0.2 mg/cm ² -event)
ABS	=	Absorption fraction (unitless)(chemical specific)

(v) Soil Vapors. Soil with volatile hazardous substances shall not cause ambient air and air within structures to exceed air cleanup levels established under WAC 173-340-750. Generally, chemicals where this is a concern are those with a molecular weight less than or equal to 200 grams/mole OR a Henry's Law constant greater than or equal to 10⁻³ atm-m³/ mole . For petroleum contamination, this is generally both aromatic and aliphatic constituents up to and including EC 16. The following methods may be used to demonstrate compliance with this requirement:

(A) Measurements of the soil vapor concentrations, using methods approved by the department, demonstrating vapors in the soil do not exceed air cleanup levels established under WAC 173-340-750;

(B) Soil total petroleum hydrocarbon concentrations and petroleum component concentrations that do not exceed the values in table 740-1 ;

(C) Using an active vapor extraction system with off-gas capture or treatment (e.g. granular activated carbon or thermal treatment of off-gas). The system shall be operated until soil vapor concentrations no longer exceed air cleanup level established under WAC 173-340-750 or the soils no longer exceed the soil cleanup levels in table 740-1.

(D) Using modeling methods approved by the department and demonstrating the vapor concentrations in the ambient air and air within structures will not exceed the air cleanup levels established under WAC 173-340-750. When this method is used, the department may require soil vapor and/or air monitoring be conducted to verify the calculations and compliance with air

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cleanup levels. The following approaches may be used to calculate a soil cleanup level that is protective of ambient air and air within structures:

- Subsurface soil to subsurface structures. The default approach to this route shall include diffusion and advective flow in a porous media. It may also account for any resistance to flow that is provided by the floor or foundation of the enclosed space and mixing within the building. The Johnson and Ettinger model combined with a fixed-box mixing term inside the building includes these elements and may be used. Ecology may approve other methods if it determines the methods adequately model transport mechanisms.
- Surface soil to ambient air. The default approach to this route shall include diffusion flow in a porous media and may include mixing in ambient air. The Jury infinite and finite models combined with EPA's Q/C term includes these elements and may be used. A decision on the use of infinite or finite source calculations should be based on conditions at the site and which equation will most accurately estimate air concentrations. Ecology may approve other methods if it determines the methods adequately model transport mechanisms.
- Ecology may require other approaches for evaluating vapor transport where the above methods do not adequately protect human health or the environment.

(vi) Concentrations which result in no significant adverse effects on the protection and propagation of ~~vegetation or~~ wildlife established using the procedures specified in WAC 173-340-709.

(b) The department may establish method C cleanup levels that are more stringent than those required by (a) of this subsection when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-702 & 708.

(5) ~~Multiple hazardous substances/multiple pathways of exposure.~~

Adjustments to site cleanup levels.

(a) Total site risk adjustments. Soil cleanup levels for individual hazardous substances developed in accordance with subsection (4) of this section, including cleanup levels based on state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures specified in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}).

(b) ~~These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including cleanup levels based on applicable state and federal laws.~~ Where a cleanup level developed under subsection (2) or (3) of this section is based on an applicable state or federal law and the level of risk upon which the standard is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}) and the hazard index does not exceed one (1) at the site.

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(c) Natural background and PQL considerations. Cleanup levels determined under subsections (2) and (3) of this section, including cleanup levels adjusted under provisions (5)(a) and (5)(b) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.

(6) Point of compliance. The point of compliance shall be established in accordance with WAC 173-340-740(6).

(7) Compliance monitoring. Compliance monitoring shall be performed in accordance with WAC 173-340-410 and 173-340-740(7).

WAC 173-340-750 Cleanup Standards to Protect Air Quality. (1) General considerations.

(a) Cleanup levels to protect air quality shall be based on estimates of the reasonable maximum exposure expected to occur under both current and future site use conditions. The department has determined that residential site use will generally require the most protective ambient and interior air cleanup levels and that exposure to hazardous substances under these conditions represents the reasonable maximum exposure. Air cleanup levels for this presumed exposure scenario shall be established in accordance with methods A or B cleanup levels described in subsections (2) and (3) of this section. In the event of a release or potential release of hazardous substances into the ambient air or air within a structure, treatment, removal, or containment measures a cleanup action complying with WAC 173-340-360 shall be conducted to reduce the levels of hazardous substances in the ambient air to levels consistent with this use unless it can be demonstrated that the facility qualifies for a method C cleanup level under subsection (4) of this section or all of the following can be demonstrated:

~~—— (i) The site does not serve as a current residential area;~~
~~—— (ii) The site is not likely to become a residential area in the future based on a review of site zoning, statutory or regulatory restrictions, comprehensive plans, historic site use, adjacent land uses, and other relevant factors;~~
~~—— (iii) Appropriate institutional controls are implemented at the site to prohibit residential use; and~~
~~—— (iv) Air emissions from the site will not reduce the air quality in adjacent residential areas; or~~
~~—— (v) More stringent concentrations are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision must comply with WAC 173-340-708.~~

~~—— (b) Ambient air cleanup levels for nonresidential site uses shall be established on a case-by-case basis. The overall limits on the hazard index and total excess cancer risk specified in subsections (3) through (5) of this section shall apply to these sites. Cleanup levels for these types of sites shall be at least as stringent as method C cleanup levels established under subsection (4) of this section.~~

~~(c) (b) Ambient~~ Air cleanup levels shall be established at concentrations which do not directly or indirectly cause violations of ground water, surface water, or soil cleanup standards established under this chapter or applicable state and federal laws.

(2) Method A air cleanup levels. Method A air cleanup levels may be used at any site with a limited number of hazardous substances with the same toxic effect and limited exposure pathways (so that additive effects need not be considered).

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(a) Method A cleanup levels for ambient air and any air within a structure that is accessible by humans shall be at least as stringent as all of the following:

- (i) Concentrations established under applicable state and federal laws; and,
- (ii) For sites with additional hazardous substances which are deemed indicator hazardous substances under WAC 173-340-708(2) for which there is no value available under applicable state and federal laws, cleanup levels for these additional hazardous substances shall be established at the natural background concentration or the practical quantification limit, subject to the limitations in this chapter.

(b) The department may establish method A cleanup levels that are more stringent than those required by (a) of this subsection when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment. Any imposition of more stringent requirements under this provision shall comply with WAC 173-340-708.

(c) As used in this section, a structure which is accessible by humans is a building, utility vault, manhole or similar structure big enough for a person to fit into the structure.

(3) Method B cleanup levels.

(a) Method B cleanup levels for ambient air and any air within a structure that is accessible by humans shall be at least as stringent as all of the following:

- (i) Concentrations established under applicable state and federal laws; and
- (ii) For hazardous substances for which sufficiently protective health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:

(A) Concentrations which are estimated to result in no acute or chronic toxic effects on human health and are determined using the following equation and standard exposure assumptions:

$$\text{Ambient air cleanup level (ug/l)} = \frac{\text{RFD} \times \text{ABW} \times \text{UCF} \times \text{HQ}}{\text{BR} \times \text{ABS}}$$

Where:

RFD	=	Reference Dose as specified in WAC 173-340-708(7) (mg/kg-day)
BW	=	Body weight (16 kg)
UCF	=	Units conversion factor (1,000 ug/mg)
BR	=	Breathing rate (10 m ³ /day)
ABS	=	Absorption percentage (1.0)
HQ	=	Hazard Quotient (1);

(B) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to ~~4 in 1,000,000~~ one in one million (1 X 10⁻⁶) and are determined using the following equation and standard exposure assumptions:

$$\text{Ambient air cleanup level (ug/l)} = \frac{\text{RISK} \times \text{BW} \times \text{LIFE} \times \text{UCF}}{\text{CPF} \times \text{BR} \times \text{ABS} \times \text{DUR}}$$

Where:

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RISK = Acceptable cancer risk level (1 in 1,000,000)
BW = Body weight (70 kg)
LIFE = Lifetime (75 years)
UCF = Units conversion factor (1,000 ug/mg)
CPF = Carcinogenic potency factor as specified in WAC 173-340-708(8) (kg-day/mg)
BR = Breathing rate (20 m³/day) for ambient air; 15 m³/day for indoor air
ABS = Absorption percentage (1.0)
DUR = Duration of exposure (30 years);

(b) The department may establish method B cleanup levels that are more stringent than those required by (a) of this subsection, when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment.

(4) Method C air cleanup levels.

(a) Method C air cleanup levels may be approved by the department if the person undertaking the cleanup action can demonstrate that such levels are consistent with applicable state and federal laws, that best available control technology has been utilized to control emissions and ~~that one or more of the following conditions in WAC 173-340-707(1) exist:~~

(i) The facility is an industrial property qualifying for this designation under WAC 173-340-745, or

(ii) The structure for which an indoor air cleanup level is being established is only accessible to adult workers; and,

(iii) The cleanup action provides for appropriate institutional controls implemented in accordance with WAC 173-340-440 to limit potential exposure to residual hazardous substances. This shall include, at a minimum, placement of a covenant on the property restricting use of the area of the site where method C air cleanup levels are proposed to uses consistent with (i) or (ii), above.

(b) Method C cleanup levels for ambient air and any air within a structure that is accessible by humans shall be at least as stringent as all of the following:

(i) Concentrations established under applicable state and federal laws; and

(ii) For hazardous substances for which sufficiently protective health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health and the environment as determined by the following methods:

(A) Concentrations which are anticipated to result in no significant acute or chronic effects on human health and are estimated in accordance with WAC 173-340-750 (3)(a)(ii)(A) except that the average body weight shall be 70 kg and the estimated breathing rate shall be 20 m³/day for ambient air and 15 m³/day for indoor air; and

(B) For known or suspected carcinogens, concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one hundred thousand (1 X 10⁻⁵) ~~1 in 100,000~~ and are determined in accordance with WAC 173-340-750 (3)(a)(ii)(B).

(c) The department may establish method C cleanup levels that are more stringent than those required by (b) of this subsection, when, based on a site-specific evaluation, the department determines that such levels are necessary to protect human health and the environment.

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~~(5) Multiple hazardous substances/multiple pathways of exposure. Adjustments to cleanup levels.~~

(a) Total site risk adjustments. Air cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including cleanup levels based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed one in one hundred thousand (1×10^{-5}).

~~(b) Adjustments to ARARs. These overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including those cleanup levels based on applicable state and federal laws. Where a cleanup level developed under subsection (2) or (3) of this section is based on an applicable state or federal law and the level of risk upon which the standard is based exceeds an excess cancer risk of one in one hundred thousand (1×10^{-5}) or a hazard index of one (1), the cleanup level must be adjusted downward so that the total excess cancer risk does not exceed one in one hundred thousand (1×10^{-5}) and the hazard index does not exceed one (1) at the site.~~

~~(c) Natural background and PQL considerations. Cleanup levels determined under subsections (2) and (3) of this section, including cleanup levels adjusted under provisions (5)(a) and (5)(b) of this section, are not required to be set at levels below natural background or the practical quantitation limit. See WAC 173-340-708(11) and WAC 173-340-707 for additional requirements pertaining to natural background and practical quantitation limits.~~

~~(6) Points of compliance. Cleanup levels established under subsections (2), (3), (4), and (5) of this section shall be attained in the ambient air throughout the site including within any structures accessible to humans. For sites determined to be industrial sites under the criteria in WAC 173-340-745, the department may approve a conditional point of compliance not to exceed the property boundary.~~

(7) Compliance monitoring.

(a) Sampling and analytical procedures shall be defined in a compliance monitoring plan prepared under WAC 173-340-410. The sample design shall provide data which are representative of the site.

(b) Data analysis and evaluation procedures used to evaluate compliance with ~~ambient~~ air cleanup levels shall be defined in a compliance monitoring plan prepared under WAC 173-340-410.

(c) Averaging times specified in applicable state and federal laws shall be used to demonstrate compliance with those requirements.

(d) When cleanup levels are not based on applicable state and federal laws, the following averaging times shall be used:

(i) Compliance with ~~ambient~~ air cleanup levels for noncarcinogens shall be based on twenty-four-hour time weighted averages except where the cleanup level is based upon an inhalation reference dose which specifies an alternate averaging time;

(ii) Compliance with ~~ambient~~ air cleanup levels for carcinogens shall be based on annual average concentrations.

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WAC 173-340-760 Sediment cleanup standards reserved.— (1) General considerations. In addition to any applicable requirements in this chapter, sediment cleanup actions conducted under this chapter shall comply with the requirements of Chapter 173-204 WAC, Sediment Management Standards. In general, where there are inconsistencies between this chapter and Chapter 173-204 WAC for establishing cleanup levels or selecting remedies, Chapter 173-204 WAC shall govern. However, there are certain requirements in this chapter that must be applied when conducting sediment remedial actions under authority of the model toxics control act as follows:

(a) Sediment cleanup actions must select a remedy that is permanent to the maximum extent practicable. In many instances, this requirement can be met by following the the sediment cleanup study requirements in WAC 173-204-560. Persons conducting cleanups should consult with the department to insure adequate information is included in the sediment cleanup study to make this demonstration.

(b) Specific protocols for determining sediment cleanup levels and remedial levels that are protective of human health are not described in this chapter. Such assessments shall be conducted as prescribed in Chapter 173-204, or where not prescribed in that chapter, on a case-by-case basis using the relevant requirements in WAC 173-340-708. When conducting human health risk assessments to establish sediment cleanup levels and sediment active remediation area, the following levels of risk shall apply:

(i) Concentrations for individual hazardous substances which are estimated to result in no acute or chronic toxic effects on human health as determined using a hazard quotient of one (1);

(ii) For known or suspected carcinogens, hazardous substance concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to one in one million (1×10^{-6}) for “sediment quality standards” under Chapter 173-204 WAC and less than or equal to one in one hundred thousand (1×10^{-5}) for sediment “minimum cleanup levels” under Chapter 173-204 WAC.

(iii) The limitations on additive risk in WAC 173-340-708 (5) and (6) shall apply.

(c) Freshwater sediment cleanup standards shall be established on a site specific basis using appropriate bioassays and a human health risk assessment procedures as determined by the department.

PART VIII - GENERAL PROVISIONS

WAC 173-340-800 Property Access. (1) Normal entry procedures. Whenever there is a reasonable basis to believe that a release or threatened release of a hazardous substance may exist, the department's authorized employees, agents or contractors may, after reasonable notice, enter upon any real property, public or private, to conduct investigations or remedial actions. The notice shall briefly describe the reason for requesting access. For the purpose of this subsection, unless earlier access is granted, reasonable notice shall mean:

(a) Written notice to site owner and operator to the extent known to the department, sent through the United States Postal Service at least three days prior to entry; or

(b) Notice to site owner and operator to the extent known to the department, in person or by telephone at least twenty-four hours prior to entry.

(2) Notification of property owner. The department will ask a resident, occupant, or other persons in custody of the site to identify the name and address of owners of the

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property. If an owner is identified who has not been previously notified, the department will make a prompt and reasonable effort to notify such owners of remedial actions planned or conducted.

(3) Orders and consent decrees. Whenever investigations or remedial actions are conducted under a consent decree or order, a potentially liable person shall not deny access to the department's authorized employees, agents, or contractors to enter and move freely about the property to oversee and verify investigations and remedial actions being performed.

(4) Ongoing operations. Persons gaining access under this section shall take all reasonable precautions to avoid disrupting the ongoing operations on a site. Such persons shall comply with all state and federal safety and health requirements which the department determines to be applicable.

(5) Access to documents. The department's authorized employees, agents or contractors may, after reasonable notice, enter property for the purpose of inspecting documents relating to a release or threatened release at the facility. Persons maintaining such documents shall:

(a) Provide access during normal business hours and allow the department to copy these documents; or

(b) At the department's request, provide legible copies of the requested documents to the department.

(6) Emergency entry. Notice by the department's authorized employees, agents, or contractors is not required for entry onto property to investigate, mitigate, or abate an emergency posed by the release or threatened release of a hazardous substance. The department will make efforts which are reasonable under the circumstances to promptly notify those owners and operators to the extent known to the department of the actions taken.

(7) Other authorities. Where consent has not been obtained for entry, the department shall secure access in a manner consistent with state and federal law, including compliance with any warrant requirements. Nothing in this chapter shall affect site access authority granted under other state laws and regulations.

(8) Access by potentially liable persons. The department shall make reasonable efforts to facilitate access to real property and documents for persons who are conducting remedial actions under either an order or decree.

(9) Information sharing. The department will provide the documents and factual information on releases or threatened releases obtained through this section to persons who request such in accordance with chapter 42.17 RCW and chapter 173-03 WAC. The department does not intend application of these authorities to limit its sharing of such factual information.

(10) Split samples. Whenever the department intends to perform sampling at a site, it shall indicate in its notification under subsection (1) of this section whether sampling may occur. The person receiving notice may take split samples, provided this does not interfere with the department's sampling.

WAC 173-340-810 Worker safety and health. (1) General provisions. Requirements under the Occupational Safety and Health Act of 1970 (29 U.S.C. Sec. 651 et seq.) and the Washington Industrial Safety and Health Act (chapter 49.17 RCW), and regulations promulgated pursuant thereto shall be applicable to remedial actions taken under this chapter. These requirements are subject to enforcement by the designated federal and

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state agencies. All governmental agencies and private employers are directly responsible for the safety and health of their own employees and compliance with those requirements. Actions taken by the department under this chapter do not constitute an exercise of statutory authority within the meaning of section (4)(b)(1) of the Occupational Safety and Health Act.

(2) Safety and health plan. Potentially liable persons responsible for undertaking remedial actions under WAC 173-340-520 through 173-340-540, shall submit a safety and health plan for the department's review and comment. The safety and health plan must be consistent with chapter 49.17 RCW and regulations promulgated pursuant thereto.

WAC 173-340-820 Sampling and analysis plans. (1) General. A sampling and analysis plan shall be prepared for all sampling activities which are part of investigation and remedial actions unless otherwise directed by the department and except for emergencies. The level of detail required in the sampling and analysis plan may vary with the scope and purpose of the sampling activity. Sampling and analysis plans prepared under an order or decree shall be submitted to the department for review and approval.

(2) Contents. The sampling and analysis plan shall specify procedures which ensure that sample collection, handling, and analysis will result in data of sufficient quality to plan and evaluate remedial actions at the site. Additionally, information necessary to insure proper planning and implementation of sampling activities shall be included. References to standard protocols or procedures manuals may be used provided the information referenced is readily available to the department. The sampling and analysis plan shall contain:

(a) A statement on the purpose and objectives of the data collection, including quality assurance and quality control requirements;

(b) Organization and responsibilities for the sampling and analysis activities;

(c) Requirements for sampling activities including:

(i) Project schedule;

(ii) Identification and justification of location and frequency of sampling;

(iii) Identification and justification of parameters to be sampled and analyzed;

(iv) Procedures for installation of sampling devices;

(v) Procedures for sample collection and handling, including procedures for personnel and equipment decontamination;

(vi) Procedures for the management of waste materials generated by sampling activities, including installation of monitoring devices, in a manner that is protective of human health and the environment;

(vii) Description and number of quality assurance and quality control samples, including blanks and spikes;

(viii) Protocols for sample labeling and chain of custody; and

(ix) Provisions for splitting samples, where appropriate.

(d) Procedures for analysis of samples and reporting of results, including:

(i) Detection or quantification limits;

(ii) Analytical techniques and procedures;

(iii) Quality assurance and quality control procedures; and

(iv) Data reporting procedures, and where appropriate, validation procedures.

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(3) Available guidance. The department shall make available guidance for preparation of sampling and analysis plans.

WAC 173-340-830 Analytical Procedures. (1) Purpose. This section specifies acceptable analytical methods and other testing requirements for sites where remedial action is being conducted under this chapter.

(2) General requirements.

(a) All hazardous substance analyses shall be conducted by a laboratory accredited under chapter 173-50 WAC, unless otherwise approved by the department .

(b) All analytical procedures used shall be done in accordance with a sampling and analysis plan prepared under WAC 173 -340-820.

(c) Tests for which methods have not been specified in this section shall be performed using standard methods or procedures such as those specified by the American Society for Testing of Materials, when available, unless otherwise approved by the department.

(d) Samples shall be analyzed consistent with methods appropriate for the site, the media being analyzed, the hazardous substances being analyzed for, and the anticipated use of the data.

(e) The department may require or approve modifications to the standard analytical methods identified in subsection (4) of this section to provide lower quantitation limits, improved accuracy, greater precision, or to address the factors in (d) of this subsection.

(f) Limits of quantitation. Laboratories shall achieve the lowest practical quantitation limits consistent with the selected method and WAC 173 -340-707.

(3) Multiple methods.

(a) Where there is more than one method specified in subsection (4) of this section with a practical quantitation limit less than the cleanup standard, any of the methods may be selected. In these situations, considerations in selecting a particular method may include confidence in the data, analytical costs, and considerations relating to quality assurance or analysis efficiencies.

(b) The department may require an analysis to be conducted by more than one method in order to provide higher data quality. For example, the department may require that different separation and detection techniques be used to verify the presence of a hazardous substance ("qualification") and determine the concentration of the hazardous substance ("quantitation").

(4) Analytical methods.

(a) The methods used for sample collection, sample preservation, transportation, allowable time before analysis, sample preparation, analysis, method detection limits, practical quantitation limits, quality control, quality assurance and other technical requirements and specifications shall comply with the following requirements, as applicable:

(i) Method 1. **Test Methods for Evaluating Solid Waste**, U.S. EPA, SW-846 and ~~any revisions or amendments thereto~~ third edition, third update (1997);

(ii) Method 2. **Methods for Chemical Analysis of Water and Wastes**, U.S. EPA, EPA- 600/4-79-020 and ~~any revisions or amendments thereto~~ March 1979 and March 1983 revision;

(iii) Method 3. **Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act**, 40 CFR Chapter 1 Part 136, and ~~Appendix A, B,~~

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and C, U.S. EPA and any revisions or amendments thereto Appendices A, B, C and D, U.S. EPA, July 1, 1995;

(iv) Method 4. **Standard Methods for the Examination of Water and Wastewater**, American Public Health Association, American Water Works Association, and Water Pollution Control Federation ~~and any revisions or amendments thereto~~ 18th edition, 1992;

(v) Method 5. **Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound**, Puget Sound Estuary Program/Tetra Tech, ~~1986 and any revisions or amendments thereto~~ 1996 edition;

(vi) Method 6. **Quality Assurance Interim Guidelines for Water Quality Sampling and Analysis**, Groundwater Management Areas Program, Washington Department of Ecology, Water Quality Investigations Section, December 1986 ~~and any revisions or amendments thereto; or~~

(vii) Method 7. **ADD TPH METHODS HERE [see Steve Robb]**

~~(vii)~~ (viii) Equivalent methods subject to approval by the department.

(b) The methods used for a particular hazardous substance at a site shall be selected in consideration of the factors in subsection (2) of this section.

(c) Ground water. Methods 1, 2, 3 and 4, as described in (a) of this subsection, may be used to determine compliance with WAC 173-340-720.

(d) Surface water. Methods 1, 2, 3, 4 and 5 as described in (a) of this subsection, may be used to determine compliance with WAC 173-340-730.

(e) Soil. Method 1, as described in (a) of this subsection, may be used to determine compliance with WAC 173-340-740 and 173-340-745.

(f) Air. Appropriate methods for determining compliance with WAC 173-340-750 shall be selected on a case-by-case basis, in consideration of the factors in subsection (2) of this section.

WAC 173-340-840 General Submittal Requirements. Unless otherwise specified by the department, all reports, plans, specifications, and similar information submitted under this chapter shall meet the following requirements:

(1) Cover letter. Include a letter describing the submittal and specifying the desired department action or response.

(2) Number of copies. Three copies of the plan or report shall be submitted to the department's office responsible for the facility. The department may require additional copies to meet public participation and interagency coordination needs.

(3) Certification. A Except as otherwise provided for in Chapter 18.43.130 RCW, all engineering work submitted under this chapter shall be under the seal of a professional engineer registered with the state of Washington.

(4) Visuals. Maps, figures, photographs, and tables to clarify information or conclusions shall be legible. All maps, plan sheets, drawings, and cross-sections shall meet the following requirements:

(a) To facilitate filing and handling, be on paper no larger than 24 x 36 inches and no smaller than 8 1/2 x 11 inches. Photo-reduced copies of plan sheets may be submitted provided at least one full-sized copy of the photo-reduced sheets are included in the submittal.

(b) Identify and use appropriate and consistent scales to show all required details in sufficient clarity.

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(c) Be numbered, titled, have a legend of all symbols used, and specify drafting or origination dates.

(d) Contain a north arrow.

(e) Use United States Geological Survey datum as a basis for all elevations.

(f) For planimetric views, show a survey grid based on monuments established in the field and referenced to state plane coordinates. This requirement does not apply to conceptual diagrams or sketches when the exact location of items shown is not needed to convey the necessary information.

(g) Where grades are to be changed, show original topography in addition to showing the changed site topography. This requirement does not apply to conceptual diagrams or sketches where before and after topography is not needed to convey the necessary information.

(h) For cross-sections, identify the location and be cross-referenced to the appropriate planimetric view. A reduced diagram of a cross-section location map shall be included on the sheets with the cross-sections.

(5) Sampling data. All sampling data shall be submitted consistent with procedures specified by the department. Unless otherwise specified by the department, all such sampling data shall be submitted in both printed form and an electronic form capable of being transferred into the department's data management system.

(6) Appendix. An appendix providing the principal information relied upon in preparation of the submittal. This should include, for example: A complete citation of references; applicable raw data; a description of, or where readily available, reference to testing and sampling procedures used; relevant calculations; and any other information needed to facilitate review.

WAC 173-340-850 Recordkeeping Requirements. (1) Any remedial actions at a facility must be documented with adequate records. Such records may include: Factual information or data; relevant decision documents; and any other relevant, site specific documents or information.

(2) Unless otherwise required by the department, records shall be retained for at least ten years from the date of completion of compliance monitoring or as long as any institutional controls (including land use restrictions) remain in effect, whichever is longer.

(3) Records shall be retained by the person taking remedial action, unless the department requires that person to submit the records to the department.

(4) The department shall maintain its records in accordance with chapter 42.17 RCW.

WAC 173-340-860 Endangerment. In the event that the department determines that any activity being performed at a hazardous waste site is creating or has the potential to create a danger to human health or the environment, the department may direct such activities to cease for such period of time as it deems necessary to abate the danger.

WAC 173-340-870 Project coordinator. The potentially liable person shall designate a project coordinator for work performed under an order or decree. The project coordinator shall be the designated representative for the purposes of the order or decree. That person shall coordinate with the department and the public and shall facilitate compliance with requirements of the order or decree.

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WAC 173-340-880 Emergency actions. Nothing in this chapter shall limit the authority of the department, its employees, agents, or contractors to take or require appropriate action in the event of an emergency.

WAC 173-340-890 Severability. If any provision of this chapter or its application to any person or circumstance is held invalid, the remainder of this chapter or the application of the provision to other persons or circumstances shall not be affected.